Intelligent CableUPS®

Technical Manual

XM2, XM2-HV, XM2-HP
Effective: November 2010

Power

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Alpha Technologies

Power

Intelligent CableUPS® Technical Manual

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Effective Date: November 2010
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NOTE:

Photographs contained in this manual are for illustrative purposes only. These photographs may not match your installation.

NOTE:

Operator is cautioned to review the drawings and illustrations contained in this manual before proceeding. If there are questions regarding the safe operation of this powering system, please contact Alpha Technologies or your nearest Alpha representative.

NOTE:

Alpha shall not be held liable for any damage or injury involving its enclosures, power supplies, generators, batteries or other hardware if used or operated in any manner or subject to any condition not consistent with its intended purpose or is installed or operated in an unapproved manner or improperly maintained.

Notice of FCC Compliance

Per FCC 47 CFR 15.21:

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Per FCC 47 CFR 15.105:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.

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Safety Notes

Review the drawings and illustrations contained in this manual before proceeding. If there are any questions regarding the safe installation or operation of the system, contact Alpha Technologies or the nearest Alpha representative. Save this document for future reference.

To reduce the risk of injury or death and to ensure the continued safe operation of this product, the following symbols have been placed throughout this manual. Where these symbols appear, use extra care and attention.

ATTENTION:

The use of ATTENTION indicates specific regulatory/code requirements that may affect the placement of equipment and/or installation procedures.

NOTE:

A NOTE provides additional information to help complete a specific task or procedure.

CAUTION!

The use of CAUTION indicates safety information intended to PREVENT DAMAGE to material or equipment.

WARNING!

WARNING presents safety information to PREVENT INJURY OR DEATH to the technician or user.

Safety Precautions

- Only qualified personnel may service the Intelligent CableUPS.
- Verify the voltage requirements of the equipment to be protected (load), the AC input voltage to the power supply (line) and the output voltage of the system prior to installation.
- Equip the utility service panel with a properly rated circuit breaker for use with this power supply.
- When connecting the load, DO NOT exceed the output rating of the power supply.
- Always use proper lifting techniques whenever handling units, modules or batteries.
- The power supply contains more than one live circuit! Even though AC voltage is not present at the input, voltage may still be present at the output.
- If batteries are being stored prior to installation, recharge per manufacturer's specifications to ensure optimum performance and maximum battery service life.
- Reduce the chance of spark and wear on the connectors; always switch the inverter's battery circuit breaker off before connecting or disconnecting the battery pack
- The battery pack, which provides backup power, contains dangerous voltages. Only qualified personnel should inspect or replace batteries.
- In the event of a short-circuit, batteries present a risk of electrical shock and burns from high current. Observe proper safety precautions.
- Always wear protective clothing, insulated gloves and eye protection (i.e. safety glasses or a face shield) whenever working with batteries.
- Always carry a supply of water, such as a water jug, to wash the eyes or skin in the event of exposure to battery electrolyte.

Safety Precautions, continued

- Do not allow live battery wires to contact the enclosure chassis. Shorting battery wires can result in a fire or possible explosion.
- Always replace batteries with those of an identical type and rating. Never install old or untested batteries.
- Avoid using uninsulated tools or other conductive materials when handling batteries or working inside the enclosure.
- Remove all rings, watches and other jewelry before servicing batteries.
- Spent or damaged batteries are environmentally unsafe. Always recycle used batteries. Refer to local codes for proper disposition of batteries
- The Intelligent CableUPS has been investigated by regulatory authorities for use in various Alpha enclosures. If you are using a non-Alpha enclosure, it is your responsibility to ensure your combination conforms to your local regulatory requirements and the power supply remains within its environmental specifications.

Battery Safety Notes

- Always refer to the battery manufacturer's recommendation for selecting correct "FLOAT" and "ACCEPT" charge voltages. Failure to do so can damage the batteries.
- Verify the power supply's battery charger "FLOAT" and "ACCEPT" charger voltage settings.
- Batteries are temperature sensitive. During extremely cold conditions, a battery's charge acceptance is reduced and requires a higher charge voltage; during extremely hot conditions, a battery's charge acceptance is increased and requires a lower charge voltage. To compensate for changes in temperature, the battery charger used in the power supply is temperature compensating. Refer to Section 1.2.2 for instructions on connecting the Remote Temperature Sensor (RTS).
- If the batteries appear to be overcharged or undercharged, first check for defective batteries and then verify the correct charger voltage settings.
- To ensure optimum performance, inspect batteries every three to six months for signs of cracking, leaking or unusual swelling (note that some swelling is normal).
- Check battery terminals and connecting wires. Clean battery terminal connectors periodically and retighten to approximately 110 inch-pounds (or to manufacturer's specifications if not AlphaCells). Spray the terminals with an approved battery terminal coating such as NCP-2.

NOTE:

If installed, disconnect the AlphaGuard prior to measuring battery voltage.

NOTE:

Even with a AG-CMT present in the system, any battery which fails the 0.3V load test *must be replaced with an identical type of battery.*

- Check battery voltages UNDER LOAD. Use a load tester if available. Differences between any battery in the set should not be greater than 0.3Vdc.
- Refer to the battery manufacturer's recommendation for correct charger voltages and the power supply operation manual for corresponding charger settings.
- Number the batteries (1, 2, 3, etc.) inside the enclosure for easy identification (refer to the appropriate enclosure installation guide).
- Establish and maintain a battery maintenance log.

NOTE:

Always verify proper polarity of cables before connecting the batteries to the power module. The batteries are clearly marked for polarity. If the cables become interchanged at the batteries the battery breaker will trip.

Utility Power Connection Notes

ATTENTION:

Connecting to the utility should be performed only by qualified service personnel and in compliance with local electrical codes. Connection to utility power must be approved by the local utility before installing the power supply.

UL and NEC require that a service disconnect switch (UL listed) be provided by the installer and be connected between the power source and the ALPHA power supply. Connection to the power supply must include an appropriate service entrance weather head.

NOTE:

In order to accommodate the high-inrush currents normally associated with the start-up of ferroresonant transformers (400 Amp, no-trip, first-half cycle), either a “high-magnetic” or an HACR (Heating, Air Conditioning, Refrigeration) trip breaker must be used. Do not replace these breakers with a conventional service entrance breaker. Alpha recommends ONLY Square D breakers because of the increased reliability required in this powering application. High-magnetic Square D circuit breakers and a BBX option (UL Listed service entrance) are available from Alpha Technologies.

Description	Alpha Part Number	Square D Part Number
240V Installation - HACR (15A)	470-224-10	QO215
120V Installation - High-magnetic (20A)	470-017-10	QO120HM
BBX - External Service Disconnect	020-085-10	QO2 -4L70RB
BBX - External Service Disconnect	020-141-10	QO8-16L100RB

ATTENTION:

In most cases, the following configurations qualify for service entrance use when wiring a duplex receptacle to a service disconnect. Other codes may also apply. Always contact your local utility to verify the wiring conforms to applicable codes.

XM2 Connections

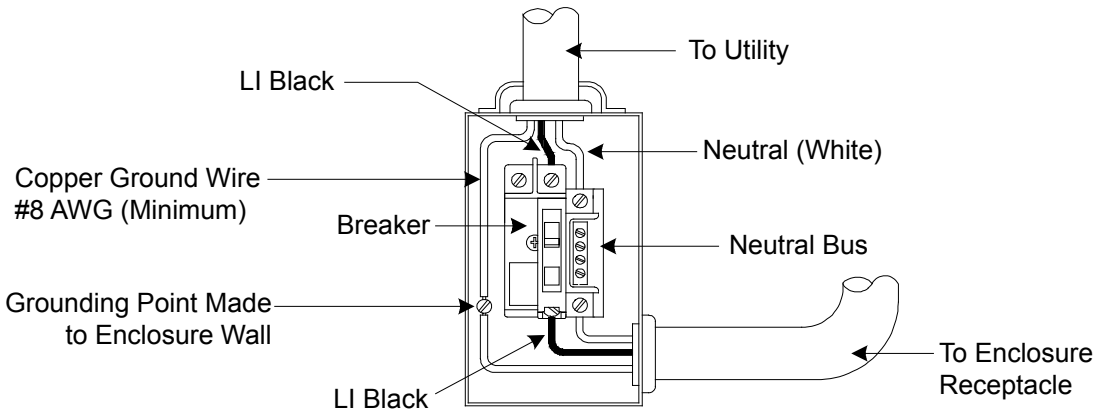
Proper 120Vac 20A service requires the installation site be:

- Equipped with a 120Vac duplex receptacle which provides power to the power supply and peripheral equipment.
- Have a NEMA 5-20R receptacle protected by a single-pole, 20 Amp High Magnetic (HM) circuit breaker inside the service entrance.
- Checked to NEC CODE to verify proper wire AWG (suggested wire gauge is 12AWG).
- Equipped with a grounding clamp on the enclosure to facilitate dedicated grounding.

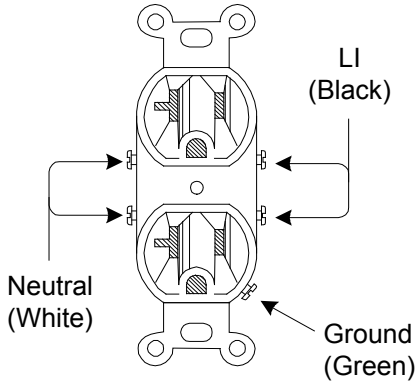
NOTE:

When bonding the box to a neutral plate is required, use the long green bonding screw provided (Alpha P/N 523-011-10, Square D P/N 40283-371-50).

Utility Power Connection Notes, continued



Typical 120Vac Service Entrance Wiring



Typical 120 Vac 20A Receptacle Wiring, 5-20R
(P/N 531-006-10)

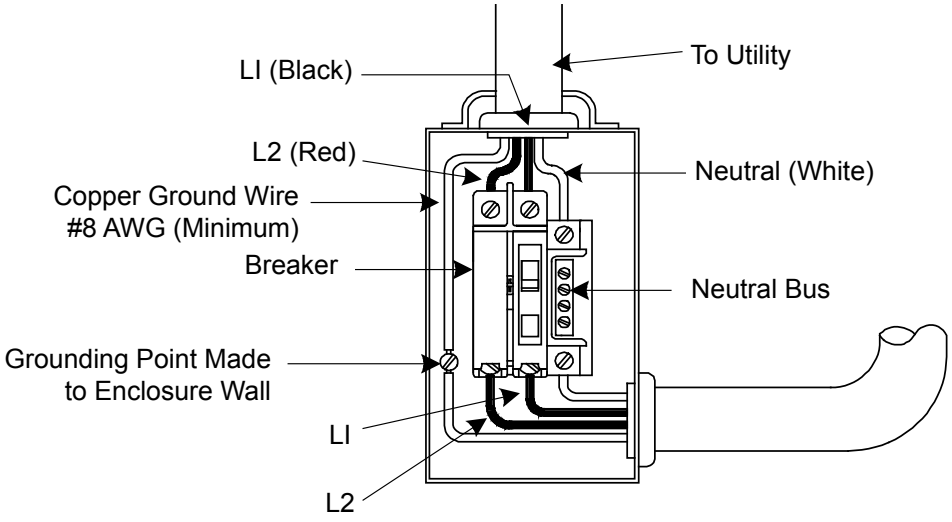
Utility Power Connection Notes, continued

Proper 240Vac 20A service requires the installation site be:

- Equipped with a 240Vac duplex receptacle to provide power to the power supply and peripheral equipment.
- Have aNEMA 6-15R receptacle is protected by a single, 2-pole, common trip 15A circuit breaker inside the service entrance.
- Checked to NEC CODE to verify proper wire AWG (suggested wire gauge is 14AWG).
- Equipped with a grounding clamp on the enclosure to facilitate dedicated grounding.

NOTE:

When bonding the box to a neutral plate is required, use the long green bonding screw provided (Alpha P/N 523-011-10, Square D P/N 40283-371-50).



Typical 240Vac Service Entrance Wiring

Grounding and Earth Connection Notes

In order to provide a ready, reliable source of backup power it is necessary to connect the power supply to an effective grounding and Earthing system that not only provides for the safety of the service personnel responsible for its operation and maintenance, but also facilitates the proper operation and protection of the equipment within the network. Such a grounding system provides protection with respect to operator safety, system communication and equipment protection.

Lightning strikes, grid switching or other aberrations on the power line and/or communications cable have the potential to cause high-energy transients that can damage the powering or communications systems. The most viable method available to protect the system from damage is to divert these unwanted high-energy transients along a low-impedance path to Earth. A low-impedance path to Earth prevents these currents from reaching high voltage levels and posing a threat to equipment.

The key to the success of lightning protection is single-point grounding so the components of the grounding system appear as a single point of uniform impedance. Two places recommended by Alpha for single-point grounding are connections in the enclosure and connections to Earth. Single-point grounding in the enclosure is achieved by bonding all electrical connections to the enclosure, including the connection to Earth, as close together on the enclosure as possible. Single-point grounding for the connection to Earth is achieved, for example by the proper bonding of the ground rods.

Safety Ground and Earth Connection

The safety ground and Earth is a two-part system, comprised of the utility service and the Alpha system.

1. First, utility service;

   As a minimum requirement for the protection of Alpha equipment, the local utility service must provide a low-impedance path for fault current return. In addition, there must be a low impedance bonded path between the Alpha Power Supply power plug Ground Pin and the Enclosure.

2. Second, the Alpha grounding system;

   The Alpha grounding system consists of a low-impedance connection between the enclosure and an Earth Ground (located at least 6’ away from the Utility Earth connection).

   This impedance between the enclosure and Earth must be 25 Ohms or less at 60 Hertz as measured by AMPROBE Model DGC-1000 or equivalent. The measurement should be made on the wire or ground rod after it exits the enclosure.

   Local soil conditions will determine the complexity of the grounding system required to meet the 25 Ohm (maximum) resistance specified above. For example, a single 8’ ground rod may be sufficient to meet the requirement. In some cases, a more elaborate system may be required such as multiple ground rods connected by a #6AWG solid copper cable buried 8-12” below the surface. Where this is not possible, contact a local grounding system expert for alternate methods that will meet the 25 Ohm (maximum) specification.

All ground rod connections must be made by means of a listed grounding clamp suitable for direct burial or exothermic welding.

Power Output Return

For proper operation, the Service Power Inserter (SPI) must be securely bonded to the enclosure.

Communications Grounding

For an external status monitoring transponder, the transponder chassis is typically bonded via a separate ground wire to the enclosure. For systems using an embedded transponder, the grounding connection is typically made either through a separate chassis ground block bonded to the enclosure or by means of the internal mounting hardware which bonds the transponder through the CableUPS. Please refer to the appropriate communications product manual for installation procedures.

Alpha strongly recommends on communication cables the use of a surge arresting device electrically bonded to the Alpha Enclosure.

WARNING!

Low impedance grounding is **mandatory for personnel safety** and critical for the proper operation of the cable system**.**

1.0 Introduction

The Intelligent CableUPS powers signal processing equipment in cable television and broadband LAN distribution systems. The transformer module provides a critical load with current-limited regulated, AC power that is free of spikes, surges, sags and noise.

During AC line operation, AC power entering the power supply is converted into a *quasi* square wave and is regulated by a ferroresonant transformer at the required output voltage. The regulated voltage is connected to the load via the output connectors and some power is directed to the battery charger to maintain a float charge on the batteries.

When the incoming AC line voltage significantly deviates from normal, the inverter module automatically switches to standby operation and maintains power to the load. During the switch to standby operation, energy in the module's ferroresonant transformer continues to supply power to the load. In standby mode, the Intelligent CableUPS powers the load until the battery voltage reaches a low-battery cutoff point.

When utility power returns, the transformer module waits a short time (approximately 20 to 40 seconds) for the utility voltage and frequency to stabilize and then initiates a smooth, in phase transfer back to AC line power. Once the transfer is complete, the battery charger recharges the batteries in preparation for the next event.

NOTE:

The duration of battery-backed standby operation depends upon the type and number of batteries and the load on the power supply.

The Intelligent CableUPS contains an impressive list of features, including:

- Smart Display
- Built-in self test
- Battery test
- An optional factory-installed Protective Interface Module (PIM)

Also available is the High Performance Intelligent CableUPS which features:

- A high efficiency transformer
- Improved Status menus
- Communications menu with DOCSIS® parameters
- An optional factory-installed Protective Interface Module (PIM)

Via the Smart Display, the operator can view all of the power supply's operating parameters. Automatic scrolling (AUTO-SCROLL) is always active so there is no need to press any buttons to view the power supply's status or system parameters. In place of operating parameters, active alarms automatically indicate in the Smart Display so the operator can immediately see what fault is being detected. Troubleshooting tips automatically display in the **Alarm** menu screen.

Built-in metering circuits measure voltage and current, without the need for external test equipment. In legacy models (manufactured prior to July 2006) front panel test points provide access for manual measurements if desired.

The factory-installed Protective Interface Module (PIM) option allows the Intelligent CableUPS to function in an N+1 redundant supply system and also provides programmable current limits for two output channels.

CAUTION!

To minimize the possibility of the transformer becoming unstable, a minimum load of at least 1A is required to be connected to the output (for the XM2-906G6 and XM2-906HP, minimum load is 0.5A). Unstable transformers will self-correct as soon as a load of 1A or greater is connected to the power supply. DO NOT operate unloaded.

1.1 Theory of Operation

The Intelligent CableUPS is comprised of the:

- Transformer module, which acts as a stand-alone line conditioner. The transformer module contains a ferroresonant transformer, resonant capacitor, transfer isolation relay, Power Distribution Board and the optional Protective Interface Module (PIM) board.
- Inverter module, which is required for standby operations and contains circuitry needed for the three-stage temperature-compensated battery charger, DC to AC converter (inverter), AC line detectors and Smart Display.
- Optional communications module, used to provide external status monitoring and communications.

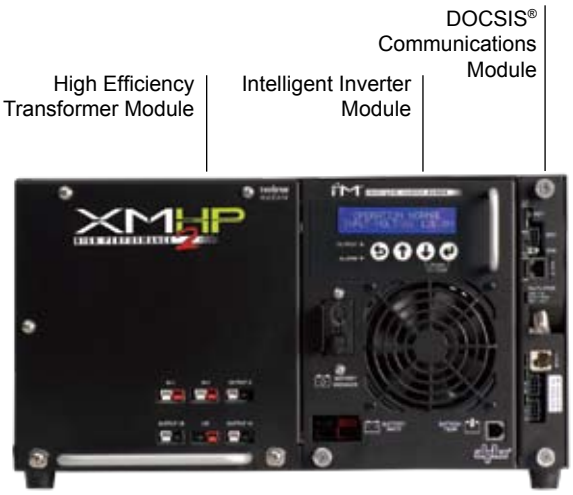


Fig. 1-1, XM2-HP Power Supply

Fig. 1-2, Standard XM2 Power Supply

1.1.1 AC (Line) Operation

During AC Line operation, utility power is routed into the primary winding of the ferroresonant transformer through the contacts of the transfer isolation relay. Simultaneously, in the inverter, power is directed to the rectifier circuitry providing power for the control circuitry. The bidirectional inverter also serves as a battery charger during line operation. The ferroresonant transformer and an AC capacitor form the resonant tank circuit, which provides excellent noise and spike attenuation, output short circuit current limiting and output voltage regulation. The ferroresonant transformer produces a *quasi* square wave output which resembles a rounded square wave.

NOTE:

When measuring the output voltage of ferroresonant transformers, use only a true RMS AC voltmeter. Non-RMS reading meters are calibrated to respond to pure sine waves and do not provide an accurate reading when measuring *quasi* square wave output.

1.1.2 Standby Operation

When the incoming AC line voltage drops or rises significantly or a complete power outage occurs, the control logic's line monitor activates standby operation. During the transfer from AC line to standby operation, the battery powered inverter comes online as the isolation relay switches to prevent AC power from back-feeding to the utility. The energy contained in the ferroresonant transformer continues to supply power to the load. The following changes also occur within the power supply:

- The isolation relay opens to disconnect the AC line from the primary winding of the ferroresonant transformer.
- The control logic drives the inverter FETs on and off at line frequency. This switching action converts the DC battery current into AC current in the inverter windings of the ferroresonant transformer, providing regulated power to the load.
- The control logic, which includes a microprocessor and other circuits to protect the inverter FETs from overcurrent damage, monitors the condition of the batteries and the inverter during standby operation. Since a prolonged AC line outage would severely discharge the batteries, resulting in permanent damage, the control logic disables the inverter when the batteries drop to approximately 10.5Vdc per battery (31.5Vdc in a three-battery set or 42.0Vdc in a four-battery set).

When acceptable AC line voltage returns, the power supply returns to AC line operation after a 20 to 40 second lag. This delay lets the AC line voltage and frequency stabilize before the control logic phase-locks the inverter's output to the utility input. The control logic then de-energizes the isolation relay, reconnects the AC line to the primary of the ferroresonant transformer and disables (turns off) the inverter. This results in a smooth, in-phase transfer back to utility power without interruption of service to the load. The battery charging circuit then activates to recharge the batteries in preparation for the next power outage.

NOTE:

The output fuse has been removed from models of the XM2 Power Supply manufactured after July 2006.

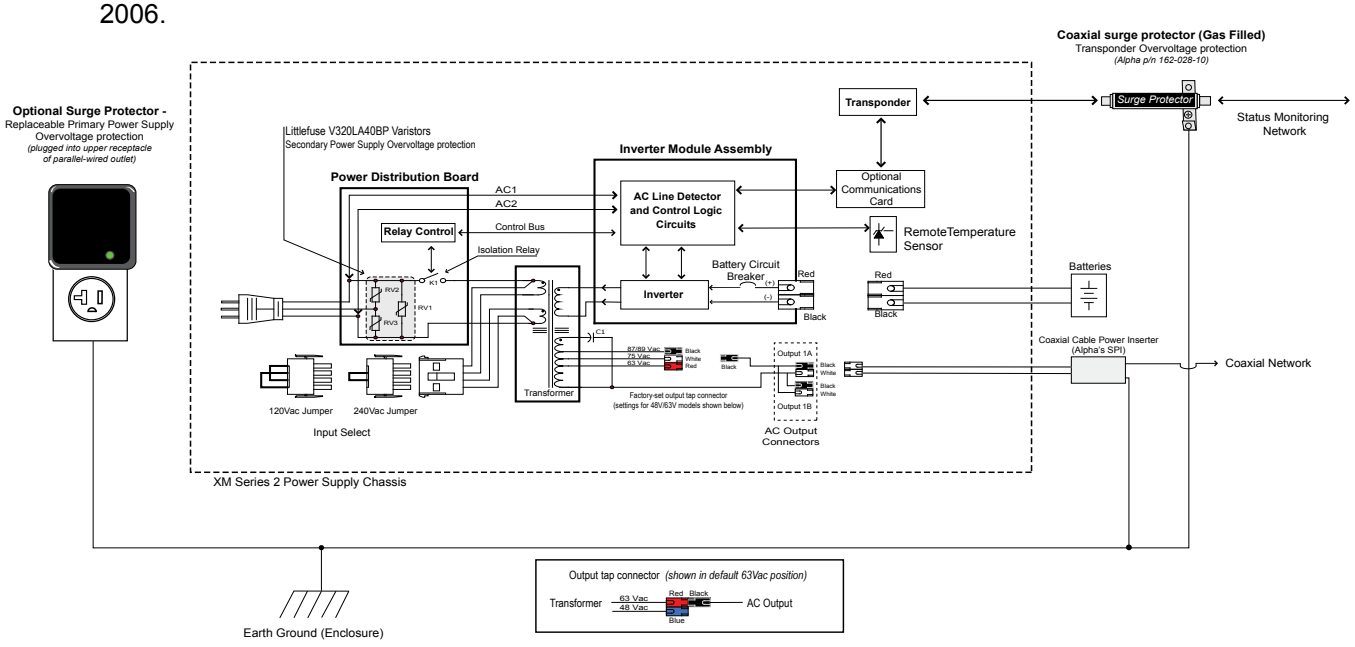


Fig. 1-3, Simplified Block Diagram

1.1.3 Charger Operation

The Intelligent CableUPS uses a three-stage, temperature-compensated battery charger. During AC line operation, the inverter winding on the ferroresonant transformer feeds the charger circuit which provides BULK, ACCEPT and FLOAT charge voltages to the batteries.

Charger Modes

BULK charge is a “Constant Current” charge. The maximum current is 10A. As the charge is returned to the batteries, their voltage increases to a specific threshold (2.27Vdc per cell). The charger then switches to ACCEPT mode. The BULK charger mode generally returns the battery charge state to 80 percent of rated battery capacity.

ACCEPT charge is a “Constant Voltage” charge. This voltage, 2.40Vdc (adjustable) per cell, is temperature-compensated to ensure longer battery life and proper completion of the charge cycle. This cycle is complete when the charging current into the batteries becomes less than 0.5A or approximately six hours elapses from the time ACCEPT mode was entered. When the batteries are fully recharged the charger switches to the FLOAT mode of operation.

FLOAT charge is a temperature-compensated “pulsed voltage” charge, averaging about 2.27Vdc (adjustable) per cell. During FLOAT mode, the batteries are fully charged and ready to provide backup power. The charger provides a small maintenance charge to overcome the batteries self-discharge characteristics and other minor DC loads within the power supply. As the battery voltage reaches the “full charge” level the time delay between pulses increases.

During ACCEPT and FLOAT modes, the cell voltage is temperature-compensated at -0.005Vdc per cell per degree C (adjustable) to ensure a safe battery cell voltage and to maximize battery life.

NOTE:

On HP models, when Alpha Cell is the selected battery type, ACCEPT and FLOAT are pre-set and are not manually selectable.

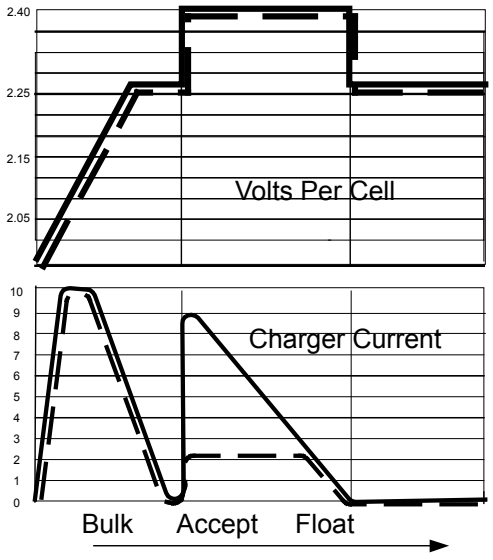


Fig. 1-4, Charger Modes
(dashed lines indicate HV models)

1.2 Intelligent CableUPS Layout

1.2.1 Transformer Module Overview

AC Output Fuse (legacy models only): Legacy XM2 power supplies use either a 20A slow blow or 30A slow blow fuse. To provide increased durability, an integrated fuse guard protects the fuse.

Output N L (legacy models only): Use the output test point (output N L) to check the AC output. Use a true RMS AC voltmeter equipped with the proper test probes; other meters may give false or inaccurate readings.

N+1 (Optional): Use the N+1 ports in redundant system configurations where multiple power supplies are housed in a single enclosure. If a power supply fails, a redundant power supply automatically switches into service (8ms delay). This feature is part of the PIM option.

LRI (Local/Remote Indicator): The LRI lamp option is used in conjunction with the automatic performance feature and plugs directly into the LRI connector. The LRI circuit is rated at 12Vdc, 250mA. This option duplicates the function of the red ALARM LED by illuminating an externally mounted red lamp for standby operation.

Output 1A (White = Neutral, Black = Line): The AC output connector is clearly marked and color-coded for easy identification. The service power inserter (SPI) connects directly into the Output 1A connector.

Output 1B (White = Neutral, Black = Line): This output is wired in parallel to Output 1A (Output 1A +1B = Output 1) and is often used for auxiliary loads.

NOTE:

The Smart Display only displays Output 1, which is the sum of Output 1A and Output 1B.

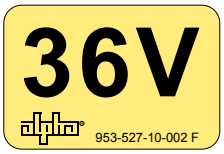
Output 2 (Optional) [White = Neutral, Black = Line]: The AC output connector is clearly marked and color-coded for easy identification. The SPI, which couples power to the load, connects directly into the Output 2 connector. This feature is part of the PIM option.

Fig. 1-5, Transformer Module Connections

1.2.2 Inverter Module Overview

The removable inverter module provides uninterrupted power to the ferroresonant transformer (via the batteries) during line failures. During line operation, the inverter charges the batteries using a three-stage (BULK, ACCEPT and FLOAT) charger.

Each inverter module and transformer module is labeled to indicate its voltage and current rating. The power supply also carries a voltage and current rating label. It is very important the inverter module is installed only in a power supply with the same voltage and current rating. If the labels do not match, do not install the inverter module. Each unit will bear a label (examples shown below) on the inverter module and on the inside chassis floor.



Current 36V Inverter Modules bear this yellow label. This label and the label located on the interior chassis floor must match. However, inverter modules carrying this yellow label are backward compatible with 36V power supplies manufactured prior to September 2006, which bear yellow labels. Do not install the inverter module if the voltages do not match.

Current 48V inverter modules bear this two-color label. This label and the label located on the interior chassis floor must match. However, inverter modules carrying this blue/green label are backward compatible with all 48V power supplies manufactured prior to September 2006, which bear green labels.

Obsolete-style label for the 1350VA 48V inverter modules. The current 1350VA 48V inverter module (manufactured after September 2006) carries a green label. If your legacy power supply carries this green voltage and current rating label, it is compatible with the latest blue/green labeled inverter module.

Fig. 1-6, Inverter Module Voltage Rating Labels

1.2 Intelligent CableUPS Layout, continued

1.2.2 Inverter Module Overview, continued

Fig. 1-7, Inverter Module Connections

Smart Display: All operational functions, system testing, setup items and alarms are available via the Smart Display panel on the front of the power supply *(the Smart Display is covered in detail in Section 4.2)*. Display functions are accessible by pressing any of the four keys: ESCAPE, UP, DOWN or ENTER. Backlighting is activated when any of the four keys are pressed and stays lit for a period of one hour. There are four levels of menu items for the standard unit: Operation Normal, Additional Information, Setup and Alarms. For units equipped with DSM2 (or newer) Communications Modules the four levels are: Operation Normal, Communication Information, Setup and Alarms. Pressing ENTER will sequence the display one level lower and pressing ESCAPE will sequence the display one level higher.

Battery Breaker: The battery breaker disconnects the batteries from the inverter module's DC circuit. With the battery breaker turned off, the power supply does not transfer to standby mode, the inverter is disabled and the battery charger cannot charge the batteries. The breaker trips when an overcurrent is detected in the DC circuitry or the battery polarity is accidently reversed.

Battery Input Connector: The battery cable connector plugs directly into the inverter module's battery input connector. The connector is polarized and fits in one direction only.

NOTE:

Always verify proper polarity of cables before connecting the batteries to the power module. Reversing the battery polarity can cause permanent damage to the power supply. Polarity is clearly marked for easy identification.

1.2 Intelligent CableUPS Layout, continued

1.2.2 Inverter Module Overview, continued

Inverter Cooling Fan: The inverter module is equipped with a cooling fan that operates during standby operation when the inverter heatsink temperature reaches 85°C. The fan stays on until the temperature drops below 75°C. The fan also operates whenever a self-test is in progress.

Temp Probe Connector: The Remote Temperature Sensor (RTS) plugs directly into the temperature probe (RJ-11C type) connector.

Batt Volt (Battery Test Point) [legacy models only]: With the battery breaker on and battery string(s) connected, DC Output can easily be checked using the inverter module's battery test point. Use a DC voltmeter whenever checking the output.

The Remote Temperature Sensor is held in place on the AlphaCell 165, 195, 210 and 220 series batteries by a Battery Spacer Clip. To install, flex the clip and hook the retaining tabs over the top of the battery and slide the sensor into place in the clip as shown below. For domestic applications, use one battery clip per 36V battery string and two clips per 48V battery string for optimal spacing. For International applications use two clips per 36V battery string and four per 48V battery string

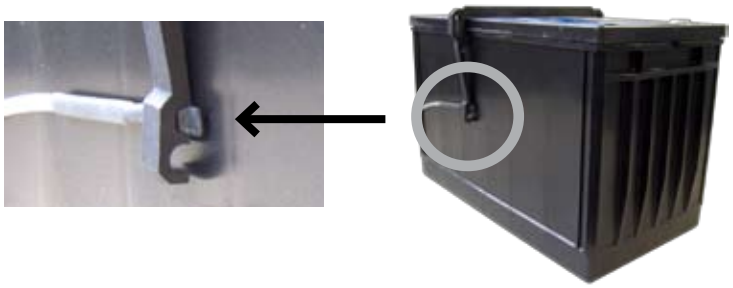


Fig. 1-8, Placement of Remote Temperature Sensor (RTS) on battery

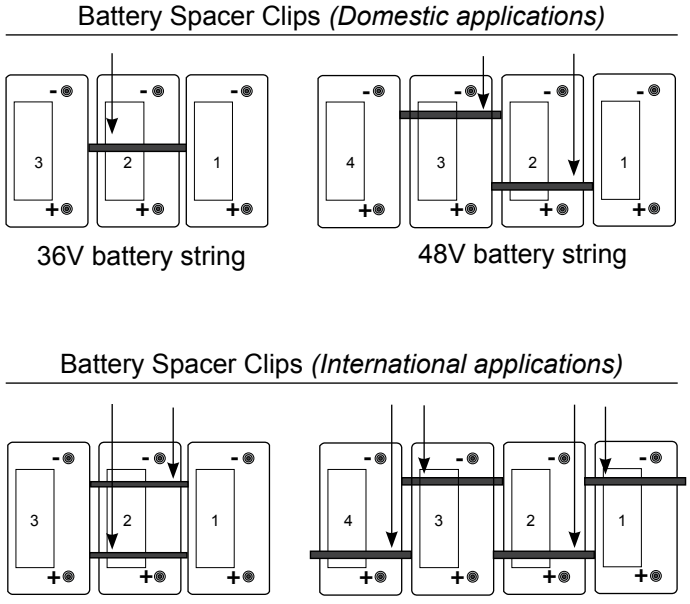


Fig. 1-9, Placement of Battery Spacer Clips on 36V and 48V battery strings

(Note: actual placement determined by battery arrangement)

1.2.3 Optional Status Monitoring Modules

The power supply supports a number of Alpha Technologies communication modules which may be ordered factory-installed or as a user-installed field upgrade.

NOTE:

If communications options are installed, Alpha highly recommends adding the coaxial surge arrestor for the transponder (See Section 1.3, Recommended Enclosure System Options).

CAUTION!

Handle these modules with extreme care. Circuit boards and logic upgrades are static-sensitive and susceptible to damage.

DOCSIS® Status Module 3x

The AlphaNet DSM3x Embedded DOCSIS Transponder allows monitoring of Alpha power supplies through existing cable network infrastructure. Multiple power supplies, batteries and a generator can be monitored using a single transponder. Advanced networking services provide quick reporting and access to critical powering information.

The DSM3x utilizes Simple Network Management Protocol (SNMP) and standard Management Information Bases (MIBs) to provide network status monitoring and diagnostics. A Web interface enables authorized personnel direct access to advanced diagnostics using a common Web browser. No custom software is required.

Fig. 1-10, DSM3x

DOCSIS® IDH3

The IDH3 Digital Embedded DOCSIS Transponder enables cable operators to manage their network powering through the existing cable modem infrastructure. Multiple power supplies, batteries and a generator can be monitored using a single transponder. Data is transmitted to a management system over the network's DOCSIS cable modem channels through the existing CMTS. Bandwidth utilization is minimized by using standard SNMP (Simple Network Management Protocol) communications. Status monitoring information is compatible with ANSI/SCTE HMS standards.

Fig. 1-11, IDH3

1.3 Recommended Enclosure System Options

These options can be factory installed or upgraded in the field by the user:

Protective Interface Module (PIM)

The PIM protects system components by shutting down the load during overcurrent and short circuit conditions. The PIM has an operator programmable overcurrent threshold (3A-24A) and a programmable overcurrent tolerance period, which specifies the time (1-10 seconds) an overcurrent condition is permitted before the output shuts down.

Using the programmable retry limit, the operator can select how many times (0-40) after a programmable delay (5-301 seconds) the PIM will attempt to reconnect an output that has been shut down. Once the limit is reached, the power supply automatically retries once every 30 minutes until the fault clears. The PIM also provides N+1 redundancy in system configurations with programmable dual outputs.

Local and Remote Indicator (LRI)

The LRI (red) lamp is located on the outside of pole-mount enclosures. Using this simple form of status monitoring operators can check the operational status of the power supply without having to climb the pole and open the enclosure. During normal AC line operation, the LRI remains off. The LRI comes on only when the power supply is running in standby mode. Whenever a fault is detected during self-test, the LRI flashes to indicate that service is required.

AC Indicator (ACI)

The AC Indicator (green lamp) is located next to the LRI on the outside of pole-mount enclosures and also acts as a simple form of status monitoring so cable technicians can check the output status of the power supply without having to climb the pole and open the enclosure. As long as there is voltage present at the output, the ACI remains on. To provide much longer life than the original light bulb design, use the ACI-LL (long life LED). Models for 60V and 90V are available. Do not use ACIs for ground mount enclosures.

LA-P+, LA-P-120T 120V, 240V (Lightning Arrestor)

The LA-P+ plugs directly into the enclosure's convenience outlet and provides additional protection from voltage spikes caused by lightning and other power disturbances. It eliminates the need for hard-wired MOVs. No additional wiring is necessary.

LA-P+ With Status Monitoring

Incorporates the same features as the LA-P+, with the additional benefit of Status Monitoring capability.

Co-axial Surge Arrestor

Alpha recommends using coaxial surge suppression for enclosure protection. The Coax Surge Protector (Alpha P/N 162-028-10) includes 75 ohm surge suppressor and mounting hardware.

APP90S /APP9022S (Service Power Supply)

The APP90S/APP9022S is a portable, non-standby power supply that provides conditioned AC power to the load when the main power module is out of service. An internal tap lets the APP90S/APP9022S be set for 90/75/60Vac applications. Use a 15A or 25A SPI (Service Power Inserter) to transfer power from the APP9015S/APP9022S to the load.

1.3 Recommended Enclosure System Options, continued

AlphaGuard™ Battery Charge Management System

The AlphaGuard Battery Charge Management System extends battery life by providing the precise voltage required for each battery. 36V (3 battery) and 48V (4 battery) versions are available. The AlphaGuard performs electrical compensation for differences in individual batteries in the string. You can configure the unit to pass measurements from the battery string to a status monitoring device, such as the EDSM card or DOCSIS transponder, using an interface cable. See the AlphaGuard System Installation Instructions, (*P/N 012-306-C0)*, for detailed information (*www.alpha.com*).

Fig. 1-12, Standard AlphaGuard

Fig. 1-13, Potted AlphaGuard

2.0 Installation

2.1 Installation Procedure

The Intelligent CableUPS can be shelf-mounted within a variety of Alpha enclosures. Complete the pre-installation instructions in Section 2.0 and the preliminary inspection and self-test procedure before you install the power supply.

CAUTION!

Read the Safety Precautions, Utility Power Connection Notes and Grounding Connection Notes (pages 8-13) before you install the power supply.

Pre-installation Inspection

1. Remove the power supply from the shipping container. Confirm the power supply, including the Remote Temperature Sensor and all other ordered options are included.
2. During shipping, components might shift. Carefully inspect the power supply and other contents for possible shipping-related failures, such as loosened or damaged connectors. If any items are damaged or missing, contact Alpha Technologies or the shipping company immediately. Most shipping companies have a short claim period.
3. Do not attempt to install a damaged power supply without first passing a complete pre-installation inspection and start-up test.

NOTE:

See the “Preliminary Inspection/Pre-Service Checklist” (Alpha P/N 017-805-B5) that accompanies each power supply. SAVE THE ORIGINAL SHIPPING CONTAINER.

Use the original shipping container if the power supply needs to be returned for service. If the original container is not available, make sure the unit is well packed with at least three inches of shock-absorbing material to prevent shipping damage.

CAUTION!

Do not use popcorn-type material. Alpha Technologies is not responsible for damage caused by improper packaging of returned units.

2.2 Installing the Optional Indicator Lamps

2.2.1 AC Indicator Lamp

The AC indicator (green lamp) is located on the outside of the enclosure. When lit, it indicates AC power is available at the power supply output and enables service personnel to determine the status of the power supply without having to climb the pole.

Installation Procedure:

1. Remove the rear-most knockout (see Fig. 2-5).
2. Feed ACI wires through the hole.
3. Slide locking nut over the wires and thread onto lamp body (see Fig. 2-1).
4. Insert the crimped contacts into the plastic connectors. The BLACK wire must always go into the BLACK housing. Insert the remaining wire *(this may be white, yellow or blue)* into the WHITE housing (see Fig. 2-2).
5. Connect the shorter BLACK/WHITE set of wires to the BLACK/WHITE wires leading from the SPI. The remaining set of longer wires connects to the Output 1A connector on the front of the power supply (Fig. 2-5).

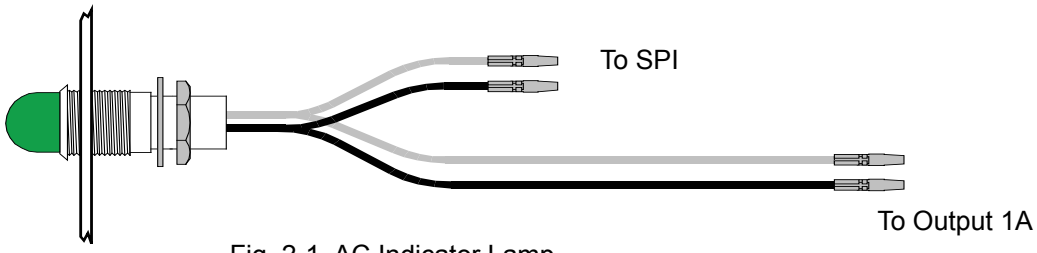


Fig. 2-1, AC Indicator Lamp

CAUTION!

Secure the contact. If you do not properly position the contact, overheating and cable assembly failure can result.

NOTE:

To remove the wire from the plastic housing, use a small screwdriver to depress the metal retainer and slide out the wire.

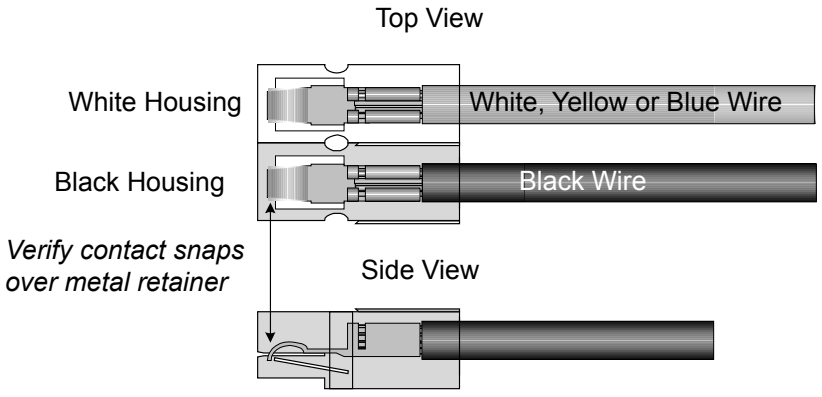


Fig. 2-2, Wire/Housing Assembly

2.2.2 Local/Remote Indicator

The Local/Remote indicator (Red lamp) is located on the outside of the enclosure. During normal AC operation, the lamp remains OFF. The lamp comes ON only when the power supply is running in Standby Mode. In the event a major alarm is detected, the lamp flashes to indicate service is required. The LRI is a simple form of status monitoring which allows the operational status of the power supply to be verified from the ground.

Installation Procedure:

1. Remove the front-most knockout (see Fig. 2-5).
2. Feed LRI wires through the hole.
3. Slide locking nut over the wires and thread onto lamp body (see Fig. 2-3).
4. Insert the crimped contacts into the plastic connectors. The BLACK wire must always go into the BLACK housing and the RED wire into the RED housing (see Fig. 2-4).
5. Connect the wire harness into the LRI connector on the front panel of the power supply.

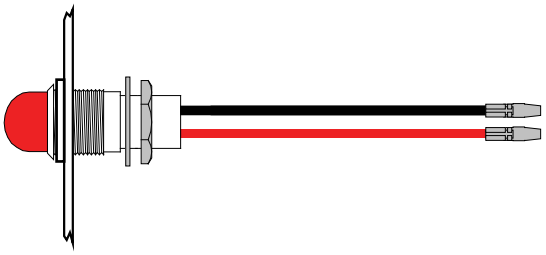


Fig. 2-3, Local/Remote Indicator Lamp

CAUTION!

Secure the contact. If you do not properly position the contact, overheating and cable assembly failure can result.

NOTE:

To remove the wire from the plastic housing, use a small screwdriver to depress the metal retainer and slide out the wire.

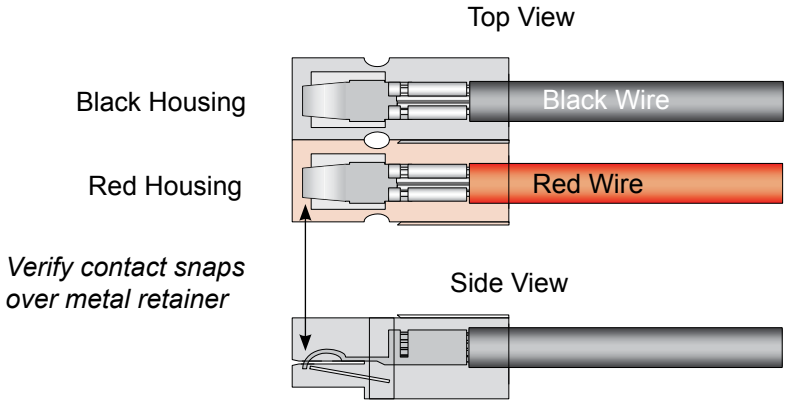


Fig. 2-4, Wire/Housing Assembly

2.2 Installing the Optional Indicator Lamps, continued

Installation is complete. Go to Start-up Test (Section 4.1, Start-up and Test).

ATTENTION:

See Section 5.6, Check Output Connections, for inspection guidelines.

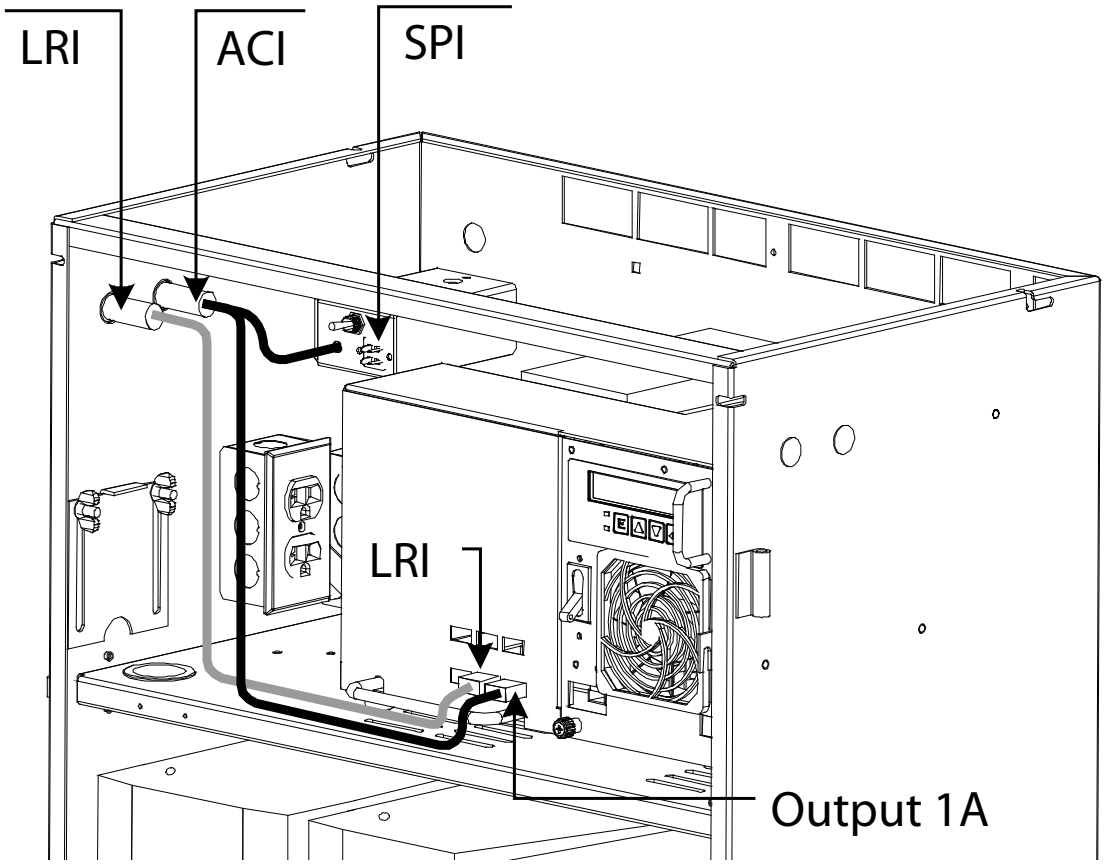


Fig. 2-5, ACI/LRI Connection

2.3 Initial Turn Up

NOTE:

Alpha enclosures are engineered to properly vent the power supply. The power supplies have been investigated by regulatory authorities for use in various Alpha enclosures. If you are using a non-Alpha enclosure, it is your responsibility to ensure your combination conforms to your local regulatory requirements and the power supply remains within its environmental specifications.

CAUTION!

Batteries are an important part of the power supply. Properly install and test all batteries, battery connections and battery cables before you connect them to the power supply.

1. Verify the Inverter Module's battery breaker is OFF.
2. Connect battery cables to battery input connector.
3. Insert temperature probe cable.
4. Insert Local/Remote Indicator (LRI) cable. (Optional)
5. Connect status monitoring connectors, including tamper switch (if installed).
6. Verify SPI switch is in "ALT" position.
7. Connect the SPI (network load) to the Output 1A connector.
8. Connect an auxiliary load (i.e. fan) to the Output 1B connector (If optional factory installed PIM has been installed).
9. Turn on AC breaker (located on enclosure) and verify correct (per unit's nameplate voltage) utility voltage at outlet; if correct, plug in XM2 line cord to the utility outlet.
10. Switch the Inverter Module's battery breaker ON.
11. Verify no alarms are present (it may take up to 60 seconds for alarms to clear).
12. Perform self-test. Initiate the self-test by simultaneously pressing the DOWN arrow key and ENTER key. Wait for Self-test completion before proceeding.
13. Perform this live inverter test procedure:
    a.) Turn AC input breaker OFF.
    b.) Verify power supply transfers to "Inverter" mode.
    c.) Turn AC input breaker ON.
    d.) Verify power supply transfers back to utility.
14. Verify Service Power Inserter (SPI) toggle switch in ON position (not ALT).

NOTE:

Output 2 is available only if the optional PIM is installed.
Use Output 1B to power auxiliary loads, such as cooling fans.

2.4 Inverter Module Removal and Installation

The Intelligent CableUPS comes with a field-replaceable inverter module assembly containing the inverter and control logic. The inverter module accepts optional communications modules to facilitate remote status monitoring. The removable module is located on the front, right-hand side of the unit.

CAUTION!

ALWAYS switch the battery breaker off before removing or installing the inverter module assembly.

Handle the inverter module with extreme care. Circuit boards and logic upgrades are static-sensitive and susceptible to damage.

NOTE:

You can remove the inverter module assembly while the power supply is running on line power. The power supply will continue to operate as a non-voltage regulated power supply.

Removal Procedure:

1. Turn off the battery breaker.
2. Disconnect the battery input and temp probe cables from the inverter module and the TMPR and XPDR cables from the communication module.
3. Loosen the thumbscrews.
4. Grasp the handle on the right side of the inverter module. Pull firmly to release the module from the inverter connector. Gently slide the module assembly straight out until the inverter module ribbon cable connector is accessible. Move the retaining clips apart and the ribbon cable will come free from the connector.

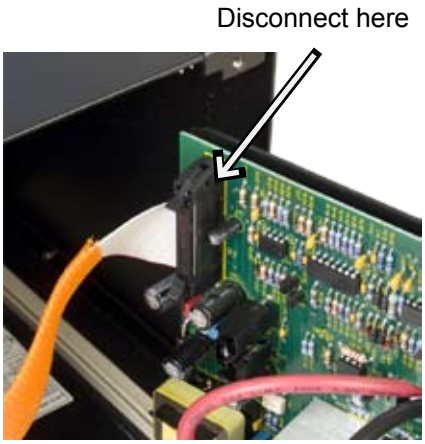


Fig. 2-6, Inverter Module Ribbon Cable

Installation Procedure:

1. Reconnect the inverter module ribbon cable to the Inverter Module circuit board by seating the cable into the connector (the locking tabs will automatically engage). Engage the sheet metal in the upper and lower guides and slide the inverter module back onto the connector. It is important the sheet metal is properly seated in the card guides and fully inserted into the housing.
2. Tighten the thumbscrews.
3. Verify the battery breaker is off. Reconnect the battery input, temp probe cables, TMPR and XPDR cables. Turn the battery breaker on.

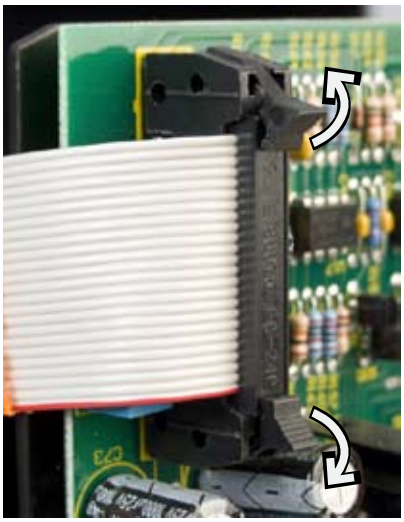


Fig. 2-7, Detail of Locking Mechanism

2.5 Protective Interface Module (PIM)

The optional (PIM) adds a second isolated output so the Intelligent CableUPS can function as an N+1 redundant supply system. It provides programmable current limits for two output channels and protects system components by shutting down the load during overcurrent and short circuit conditions.

The PIM has a programmable overcurrent threshold (3A-24A) and overcurrent tolerance period that specifies the time (1-10 secs) an overcurrent condition is permitted before shutting down.

You can use the programmable retry limit to select how many times (0-40) after a programmable delay (5-301 seconds) the PIM will attempt to reconnect an output once it has been shut down. When the limit is reached, the XM2 power supply automatically retries once every 30 minutes until the fault clears. The PIM also provides N+1 redundancy in system configurations and programmable dual outputs.

Adding the PIM to the Intelligent CableUPS provides these advantages:

- **A second isolated output:** The main purpose of the PIM is to limit the impact of a fault condition in one output channel. If a fault condition occurs in an Intelligent CableUPS (without the optional PIM installed) the entire customer network can be affected. The PIM option affords protection to one output should a fault condition exist on the other. This gives you flexibility to isolate Output 1A and 1B from Output 2.

- **A current for critical loads:** With the PIM option, you can designate one output as the primary connection and the other output as the secondary connection. Commonly, critical loads are connected to Output 1A as the primary feeder. Using the overcurrent limit settings, you can ensure the primary output always provides the necessary power. For example, on a 15 Amp power supply, if a customer needs 10 Amps available on Output 1A, the overcurrent limit for Output 2 is set at 5 Amps, so regardless of Output 2, 10 Amps will remain available for the primary Output 1.

- **Additional current protection:** The standard power supply current limit protection is provided by the fold-back characteristics of the transformer (180% of rated output). The 180% current limit may exceed the ratings of active devices in the cable network and cause failures. You can lower the maximum current provided at each output by lowering the overcurrent limit of each respective output. Therefore, to minimize failures due to excess current supply, set the overcurrent limit to a value below the maximum current the active components can tolerate.

Power Supply Load	Permitted Duration of Load
>150%	10 seconds
125% to 150%	10 minutes
115% to 125%	30 minutes
<115%	Many months

For example, on a 15A power supply, where both outputs are programmed to 10A maximum and both outputs are supplying 9A, neither output is “in violation” but the total system at 18A is operating at 120% of its rated output. In this example, after 30 minutes, the power supply will begin a “load shedding” algorithm. The first action is to disconnect Output 2. If this does not correct the system overload, the next action is to disconnect Output 1A and Output 1B (if used).

2.6 Installing the PIM

NOTE:

Only qualified personnel should install the PIM. To install the PIM you must completely shut down the power supply. To maintain output to the load, consider using either the APP9015S or APP9022S Service Power Supply during installation.

WARNING!

To avoid exposing the technician to potentially lethal voltages, before you proceed you must remove all power from the power supply; unplug the power supply from the AC power source, remove all front panel connections (such as N+1) and disconnect the battery connector.

Tools Required:

- 90° Torque driver with #2 Phillips-head bit (set to 14 inch-pounds)
- 9/32” Nut driver

To install the PIM

1. Completely shut down the Intelligent CableUPS, verify all power is removed. Ensure utility power is off and battery power is safely secured (or not installed) in the enclosure assembly. All connections and cables must be removed from the power supply. To maintain output to the load, consider using the APP9015S or APP9022S Service Power Supply when installing the PIM.

2. To remove the transformer module’s front panel, remove the five front panel screws. Lift the front panel up and away from the chassis. The front handle remains in place.

3. ***For Legacy models:*** *Use a right-angled (90°) Phillips-head screwdriver to remove the fuse wire (A). This wire may be connected to the power distribution board (PDB) by either a standoff (Fig. 2-8) or “Fast-On” connector.*

4. Remove the transformer wire (B). This wire may be connected to the PDB by either a standoff (Fig. 2-8) or “Fast-On” connector.

5. Remove the factory-installed bus bar (E) between standoffs P13 (D) and P16 (C).

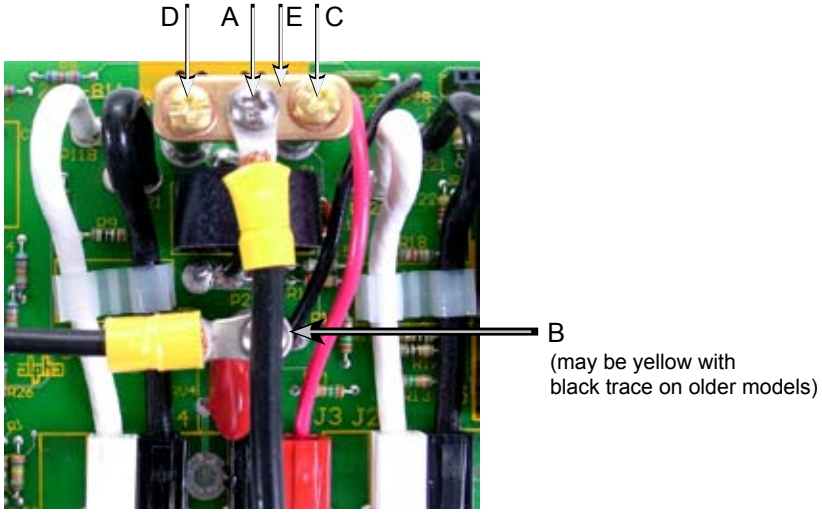


Fig. 2-8, PDB Connections

2.6 Installing the PIM, continued

6. Install the PDB header in the J4 connector of the PIM circuit board.
7. Align the PIM circuit board holes labeled P3, P5 and P4 with the standoffs (P13, P15 and P16) on the PDB. Place the PIM circuit board on the standoffs, making the J6/J4 connection. Verify the J6 pins are aligned correctly and completely seated in J4.
8. Using the provided 6-32 hardware, re-attach the:
   - Fuse/ output voltage selection block wire at P5 (on PIM board in legacy units)
   - 0-Volt wire from the transformer to P4*
9. Torque the three 6-32 screws (P3, P5 and P4) fastening the PIM circuit board to the power distribution circuit board to 14 inch-pounds (P13, P15 and P16).
10. Replace the front panel.
11. Program the PIM. See Section 2.6 for instructions.

**** For installation assistance, call Alpha Technologies technical support, 1-800-863-3364***

CAUTION!

Torque the 6-32 fastening hardware (with or without standoff) to 14 inch-pounds to avoid arcing or board failure.

NOTE:

The PIM header (Alpha P/N 545-739-10) is shipped uninstalled. Locate the header and install it between J6 on the PDB board and J4 on the PIM board.

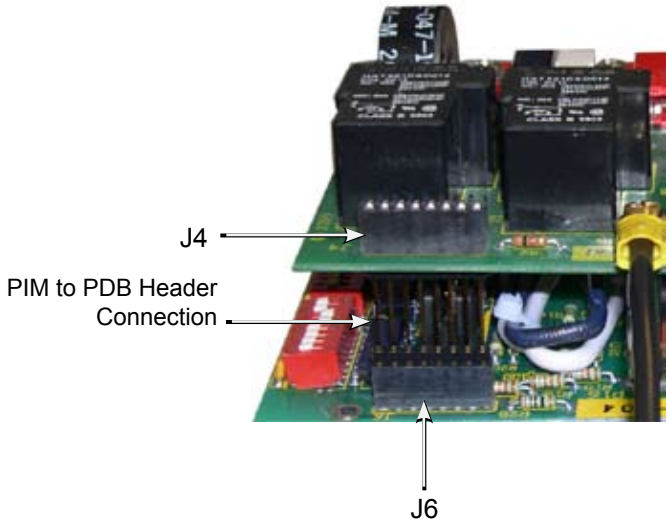


Fig. 2-9, J6 and J4 connection as seen from rear of Power Distribution Board

2.6 Installing the Optional PIM, continued

NOTE:

The output current limit for the PIM is set by the position of the jumper on JP1. Configure JP1 to the proper current setting; either 15A or 22A.* For the 918HP and 924HP Cable UPS models, set this jumper to the 22A position

**** For additional configuration assistance, call Alpha Technologies Technical Support, 1-800-863-3364***

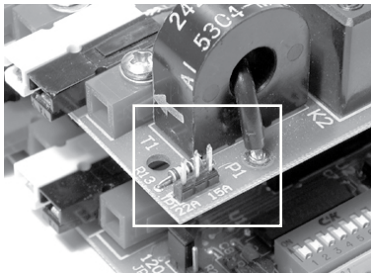


Fig. 2-10, Location of JP1 on PIM

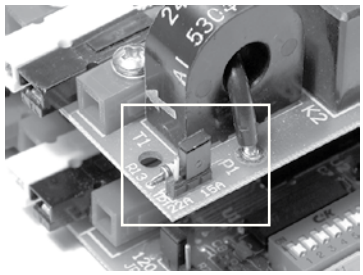


Fig. 2-11, Jumper in 15A position

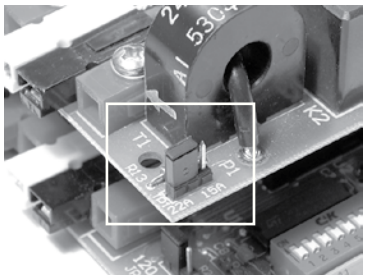


Fig. 2-12, Jumper in 22A position

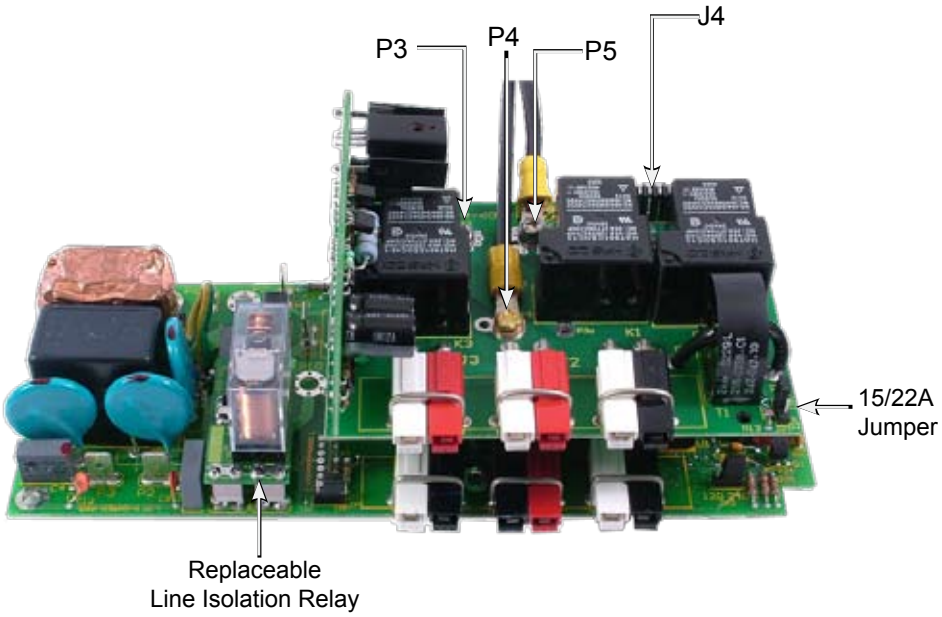


Fig. 2-13, PIM (Protective Interface Module) and PDB (Power Distribution Board)

2.7 Programming the PIM

Programmable parameters (with PIM installed) are:

Channel 1 Overcurrent Limit: The RMS current level that causes the Output 1 protection relay to trip after a specified delay (overcurrent tolerance period).

Channel 2 Overcurrent Limit: The RMS current level that causes the Output 2 protection relay to trip after a specified delay (overcurrent tolerance period).

Retry Delay: The time between each attempt to restart an output in the event of an overcurrent event.

Retry Limit: The number of times the CableUPS attempts to restart an output connection. Once the RETRY LIMIT is exceeded, standard models attempt to restart the output connection every 30 minutes (HV models do not attempt to restart after the retry limit is exceeded). Set this parameter to “zero” to disable the “automatic retry” function.

Overcurrent Tolerance Period (1-10 seconds): In the event of an overcurrent episode, the amount of time an output overcurrent condition is permitted on either output connection. Once this time expires, the output protection relay disables its output feeder.

Reset Output 1/Reset Output 2: Once fault condition has been corrected, this manually resets tripped output.

NOTE:

Programming any of the above parameters will reset the “trip/retry” counters.

N+1 (optional): The N+1 ports are used in redundant system configurations where multiple power supplies are housed in a single enclosure. With the installation of the optional Protective Interface Modules (PIM) on the power distribution board, a second output connection becomes available and allows the CableUPS to function as an N+1 redundant power supply system. In the event of a power supply failure, a redundant power supply (with an optional PIM board installed) is automatically switched into service with approximately a 8ms delay. This feature is part of the PIM option.

This provision also protects system components by shutting down the load during overcurrent and short circuit conditions. Adding a PIM in the secondary power supply enables both power supplies to be connected in a “dual redundant” configuration so the system can protect two critical loads.

NOTE:

If the optional PIM is not installed, the values shown on the “PIM PARAMETERS” line of the Smart Display are “read only”.

2.7.1 The Setup Menu

Press the Enter key to access the Setup Menu.

Use the Setup menu to view or change the programmable operating parameters of the power supply or the optional PIM. Navigation is similar to the Operation Normal menu. Press UP or DOWN to access the Single Step mode where you can individually select sub-menu items.

To select and change a value in the Setup Menu:

1. Press either UP or DOWN to put the display in the Manual Scroll Mode.
2. Continue pressing UP or DOWN until the desired item is displayed.
3. Press ENTER to select the item to edit.
4. Press UP to increase the displayed value or DOWN to decrease the value. To change the displayed values more rapidly, in Edit mode, press either UP or DOWN and hold for more than two seconds.
5. Press ENTER when the desired value is displayed. Press ENTER again to accept and save the new value. To leave programming mode without saving the new value, press ESCAPE.

   If an incorrect value is accidently entered, repeat the above process and enter the proper value or select the SET DEFAULTS menu selection of the Setup Menu and press ENTER twice to reset all parameters to their factory default values.
6. To return to the Operation Normal menu, press ESCAPE three times.

You can also access ON or OFF and YES or NO selections as described above. The CODE VER, XM_CLASS VER and Total Run Time selections are for informational display only and cannot be edited.

NOTE:

The SET DEFAULTS menu selection does not reset STANDBY TIME, STANDBY EVENTS or DEVICE ADDRESS. Manually reset these options.

2.8 N+1 Configurations

Because the PIM option provides a second output, the Intelligent CableUPS can function as an N+1 redundant supply system. The PIM also provides programmable current limits for two output channels, which protects system components by shutting down the load during overcurrent and short circuit conditions. Adding a PIM to a secondary power supply enables both power supplies to be connected in a “dual redundancy” configuration to protect two critical loads.

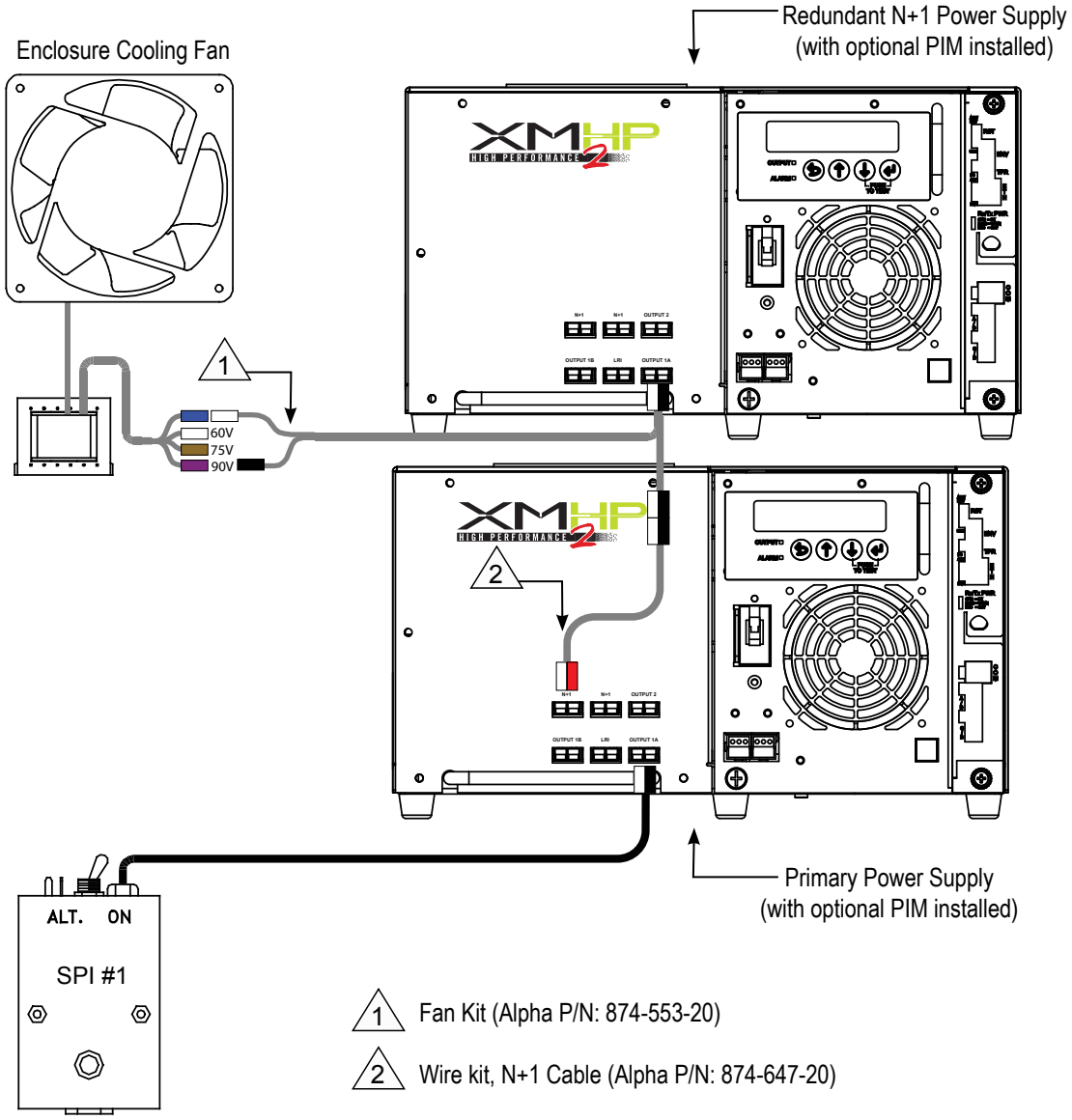


Fig. 2-14, N+1 Configuration

2.8 N+1 Configurations, continued

NOTE:

The N+1 unit and the primary unit cannot be loaded over 50% of rated capacity when configured as shown below.

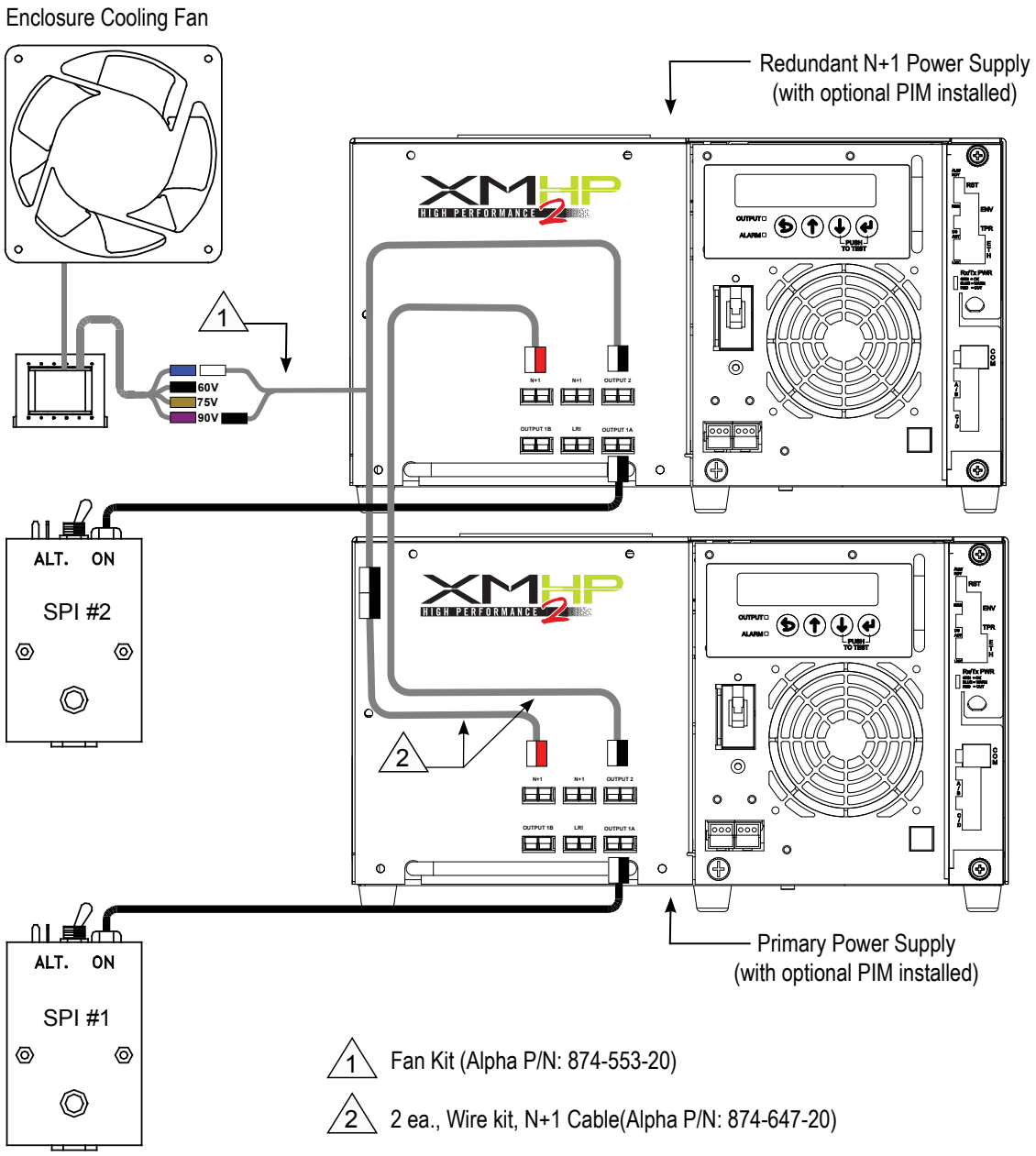


Fig. 2-15, Dual Redundancy (N+1) Configuration

2.9 Service Power Inserter (SPI)

To connect the coaxial cable

1. Before you remove the cover, unplug the SPI from the power supply.
2. Remove the two screws holding the cover to the SPI chassis.
3. Remove the SPI cover to expose the circuit board and seizure screw assembly.
4. Insert the coaxial termination into the output port on the bottom of the SPI.
5. Tighten the seizure screw to 35 inch-pounds.This will prevent arcing within the SPI due to an improperly seated cable or loose connection.

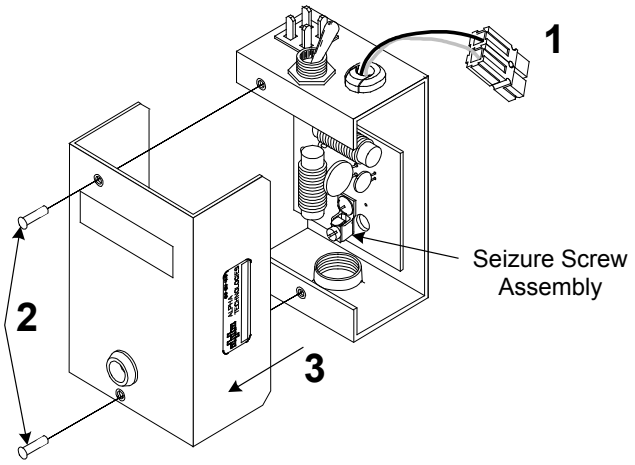


Fig. 2-16, SPI Cover Removal

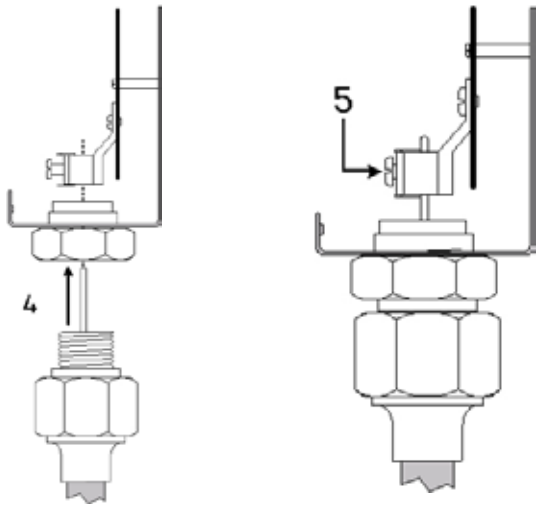


Fig. 2-17, Coaxial Cable Insertion and Securing

CAUTION!

To prevent arcing, make certain the center conductor (stinger) of the coaxial termination is fully seated inside the seizure screw assembly (5) and tightened to 35 inch-pounds.

2.9 Service Power Inserter (SPI), continued

6. Replace the SPI cover and reinstall the screws.
7. Reconnect the SPI to the power supply.
8. Using the switch on the top of the SPI, turn the unit ON to select the standby power supply as the power source to the cable plant.
9. The switch should only be in the ALT position when the standby power supply is connected to the cable. When in ALT, the standby power supply is bypassed for service or removal and provides power for status monitoring options.
10. Verify the SPI is properly grounded. Typically, grounding is accomplished by one of two methods:
    a. If the SPI has been installed with a mounting bracket, ground connection is made with paint-cutting star washers (Fig. 2-18) used in conjunction with SPI grounding wire.
    b. If the SPI doesn't use the mounting bracket, the ground connection is made via a #8 AWG wire connected to the cover of the SPI (Fig. 2-19) and terminated at the ground bar of the cabinet (Fig. 2-20).

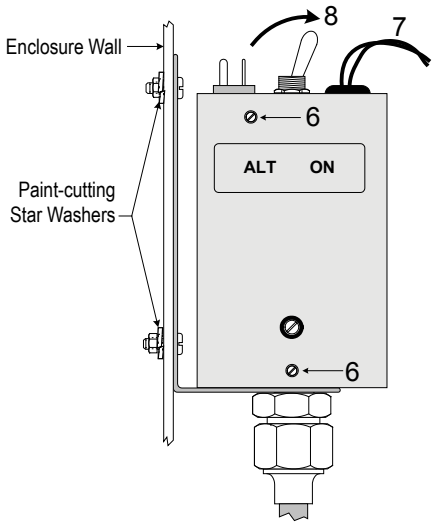


Fig. 2-18, Cover Replaced, SPI Switched On

Fig. 2-19, SPI Grounding Lug

Fig. 2-20, Enclosure Ground Bar

3.0 Configuration

3.1 Power Distribution Board (PDB) Setup

The PDB must be configured to correctly match actual power supply features and specifications. Adjustable parameters are shown in Table 3-1.

There are configuration setting features on the PDB that cannot be changed. These configurations are included in the PDB setup instructions as an aid to troubleshooting and as a reference to verify configuration. Only qualified technicians should configure the PDB.

Output Switches

Frequency (SW1-8): **Factory set** to match the ferroresonant transformer operating frequency of either 60Hz or 50Hz. Changing this setting does not change the operating frequency of the XM2. ***Do not change this setting.***

Battery Voltage (SW1-7 and SW1-6): **Factory set** to match the ferroresonant transformer and inverter module battery operating voltage of either 36Vdc or 48Vdc. Changing this setting does not change the battery voltage of the XM2. ***Do not change this setting.***

Power Rating (SW1-5 and SW1-4): **Factory set** to order. Change this setting as needed during output voltage reconfiguration. The power rating must match both the model and output voltage of the power supply. ***Only qualified technicians should change the power rating setting.***

Output Voltage (SW1-3 and SW1-2): **Factory set** to order. Change this setting as needed during output voltage reconfiguration. Output voltage must match both the model and output voltage of the power supply. ***Only qualified technicians should change the output voltage setting.***

Output Current (SW1-1): **Factory set** to order. May require changing as part of output voltage reconfiguration. Output current must match both the model and output voltage of the power supply. ***Only qualified technicians should change the output current setting.***

Input Switches

Input Voltage (SW2-6, SW2-5, SW2-4, JP1 and JP2): Factory set to order, but can be changed as needed when configuring the input voltage (120Vac to 240Vac or 240Vac to 120Vac). All input voltage elements, three switches and two jumpers, must be set to match input voltage configuration. ***Reconfiguration should only be performed by a qualified technician.***

Input Tolerance (SW2-7): Factory set to match the power supply transformer. Changing this setting can result in damage to the transformer. This setting should never be changed on standard models.

SW2-1, SW2-2, SW2-3, SW2-8 — Unused: These switches are unused and should never be changed.

3.1 Power Distribution Board (PDB) Setup, continued

The jumpers (JP-1 and JP-2) and switches (SW-1, SW-2) are located on the Power Distribution Board (PDB) as shown below.

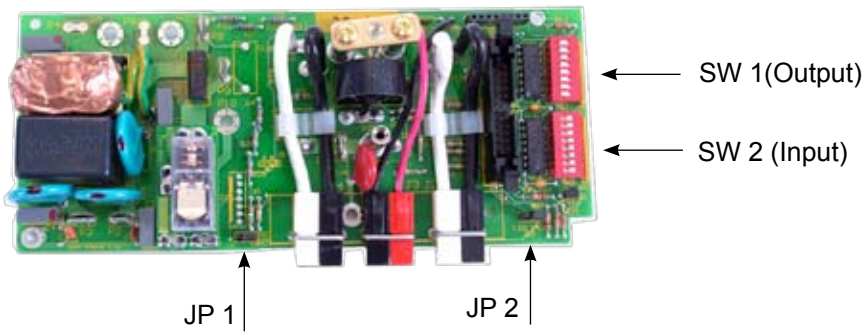


Fig. 3-1, Locations of JP1, JP2 and SW1, SW2 on the Power Distribution Board (PDB)

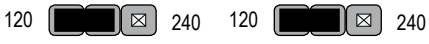
Some models of the PDB's JP1 and JP2 are two-pin jumpers, while other models have three-pin jumpers. The voltages are configured as shown below.

Two-pin jumper

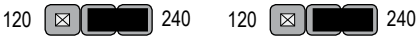
When configured for 120Vac Operation, the pins on both JP1 and JP2 will be OPEN.

When configured for 240Vac Operation, the pins on both JP1 and JP2 will be SHORTED.

Three-pin jumper



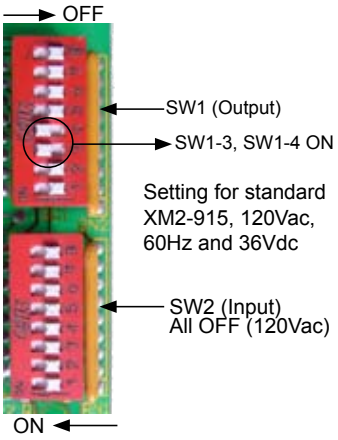
When configured for 120Vac Operation, on both JP1 and JP2 the pin marked "120" and the center pin will be shorted as shown.



When configured for 120Vac Operation, on both JP1 and JP2 the pin marked "240" and the center pin will be shorted as shown.

3.1 Power Distribution Board (PDB) Setup, continued

The table below shows the respective Jumper and Switch settings for the parameters applicable to the model of CableUPS in your system.



Frequency	60 Hz	50Hz
SW1-8	OFF	ON

Battery Voltage	36Vdc	48Vdc
SW1-7	OFF	OFF
SW1-6	OFF	ON

Power Rating	480VA / 525VA[1]/ 600VA	720VA[2]/ 900VA	1350VA	1620VA[6] / 2000VA / 2160VA[7]
SW1-5	ON	OFF	OFF	ON
SW1-4	ON	OFF	ON	OFF

Output Voltage	48Vac	63Vac	75Vac	87Vac
SW1-3	ON	OFF	OFF	ON
SW1-2	ON	OFF	ON	OFF

Output Current	<17A	>17A
SW1-1	OFF	ON

Input Voltage	100Vac	110Vac	120Vac[3]	127Vac	200Vac	220Vac	230Vac	240Vac
SW2-6	OFF	ON	OFF	ON	OFF	OFF	ON	ON
SW2-5	OFF	ON	OFF	ON	ON	ON	OFF	OFF
SW2-4	ON	OFF	OFF	ON	OFF	ON	OFF	ON
JP1 & JP2	OPEN or 120V	OPEN or 120V	OPEN or 120V	OPEN or 120V	SHORT or 240V	SHORT or 240V	SHORT or 240V	SHORT or 240V

Input Tolerance[4]	Standard and HP models	HV[5]	CFR
	+15% /–20%	+15% /–30%	±20%
SW2-7	OFF 50Hz or 60Hz	ON 60Hz only	ON 50Hz only

[1] 525VA applies only to the XM2-906G6 and the XM2-906HP. SW1-5 and SW1-4 must be ON.

[2] The output power rating of the XM2-615A when configured for 48V.

[3] The XM2-906G5 will display an Input Voltage of 115Vac when these switches are configured for 120Vac.

[4] For HV units, SW2-7 must be changed from OFF to ON when upgrading the inverter module from firmware v4.00.1 (or lower) to v4.0.1.0. See Alpha Tech Note 017-805-C0 for more information.

[5] The XM2-906G6 and XM2-906HP use HV setting and the input tolerance is +20% / –30%.

[6] Power rating for the XM2-918HP; supported by Code Version 7.08 and higher.

[7] Power rating for the XM2-924 HP; SW1-7 and SW1-6 are both set to ON. Supported by Code version7.08 and higher.

Table 3-1, Power Distribution Board Setup

3.1.1 Replacing the Metal Oxide Varistors (MOVs)

The PDB employs three MOVs that are mounted in sockets for easy replacement. MOVs must be replaced by those with comparable energy and voltage ratings. Replacement MOV P/N 160-017-19, Metal Oxide Varistor, 320Vac 420Vdc.

Tools Required:

- #2 Phillips screwdriver
- Needlenose pliers (optional)

WARNING!

Before proceeding, remove all power from the power supply by unplugging the power supply from the AC power source, removing all front panel connections (i.e., N+1) and disconnecting the battery connector. Failure to do so could expose the technician to potentially lethal voltages.

Replacement procedure:

1. Terminate all power to unit. Turn off battery breaker and unplug battery connector. Unplug line cord and remove all front panel connectors.
2. Remove the five screws securing the transformer module front panel. Set the panel and screws aside in a safe location.
3. Remove the damaged MOVs using needlenose pliers. See Fig. 3-2.
4. Insert the new MOVs firmly into the sockets. The new MOVs must have comparable energy and voltage ratings as those you are replacing.
5. Replace front cover.

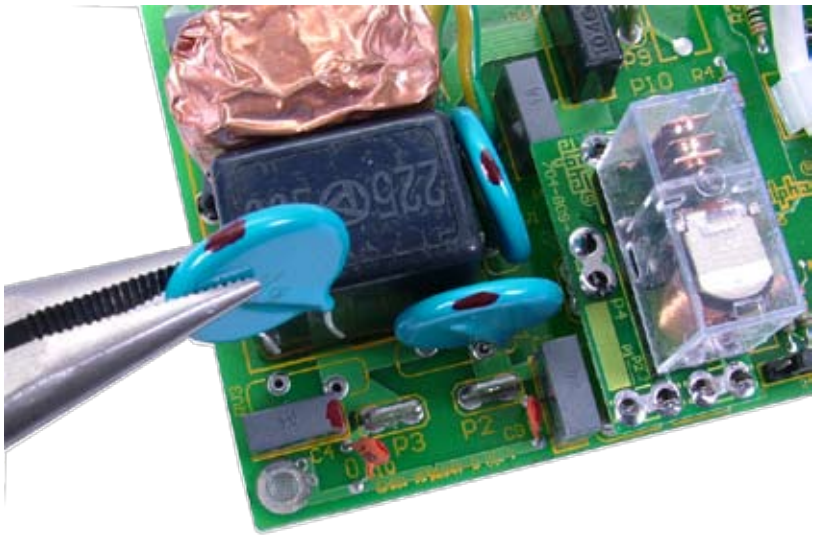


Fig. 3-2, MOV Replacement

3.1.2. Replacing the Line Isolation Relay

WARNING!

Before proceeding, remove all power from the power supply by unplugging the power supply from the AC power source, removing all front panel connections (i.e., N+1) and disconnecting the battery connector. Failure to do so could expose the technician to potentially lethal voltages.

Tools Required:

- #2 Phillips screwdriver
- Flathead Screwdriver

Replacement procedure:

1. Verify the power supply is powered off and remove AC and DC power sources from XM2. Remove the leftmost front panel using a #2 Phillips head screwdriver (screws circled at right).

2. Carefully loosen the relay circuit board with the flathead screwdriver and lift from the fixture.

3. When lowering the new relay circuit board onto the tabs, verify all tabs align with the sockets on the relay circuit board. Failure to do so will result in damage to the tabs or the sockets.

4. Verify the relay circuit board is pushed firmly into place before replacing the front panel of the power supply.

3.2 AC Input Voltage Reconfiguration

The input voltage on many models (XM2-915, XM2-918HP, XM2-910, XM2-906HP and XM2-1350) can be reconfigured from 120 to 240Vac utility input or from 240 to 120Vac utility input, depending upon utility input powering requirements.

WARNING!

To avoid exposing the technician to potentially lethal voltages, remove all power from the power supply; unplug the power supply from the AC power source, remove all front panel connections (i.e., N+1) and disconnect the battery connector.

ATTENTION:

Only qualified personnel should reconfigure the input voltage. Before modifying the power supply, always consult local electrical codes for proper wiring procedures.

NOTE:

When the AC input voltage reconfiguration is complete the voltage rating of both the high-magnetic breaker and enclosure receptacle must match the input voltage.

3.2.1 Reconfiguration from 120 to 240Vac

Tools Required:

- #2 Phillips head screwdriver
- Wire cutters and strippers
- Flat-blade screwdriver

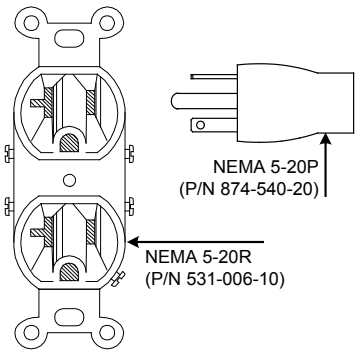
Supplies Required:

240Vac 15A plug (NEMA 6-15P, P/N 874-540-22)

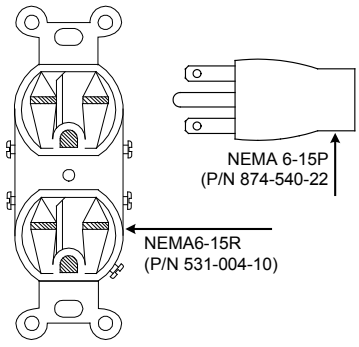
240Vac jumper (744-281-21).

Procedure (120 Input to 240Vac Input):

1. Completely shut down the XM2 power supply. Remove all utility and battery power. All connections and cables must also be removed from the XM2 power supply.
2. Verify the enclosure system wiring before proceeding with power supply modification. Refer to the appropriate enclosure installation instructions.
3. Replace the 120Vac 20A plug (NEMA 5-20P) on the XM2 power supply input line cord with a 240Vac 15A plug (NEMA 6-15P). Verify proper wiring and ground on the new plug.



120V, 20A Plug and Receptacle



240V, 15A Plug and Receptacle

Fig. 3-3, Typical NEMA Receptacles and Plugs

3.2 AC Input Voltage Reconfiguration, continued

3.2.1 Reconfiguration from 120 to 240Vac, continued

4. Locate the transformer module's input jumper in the transformer compartment. Replace the currently installed 120Vac jumper (744-281-20) with a 240Vac jumper (744-281-21).

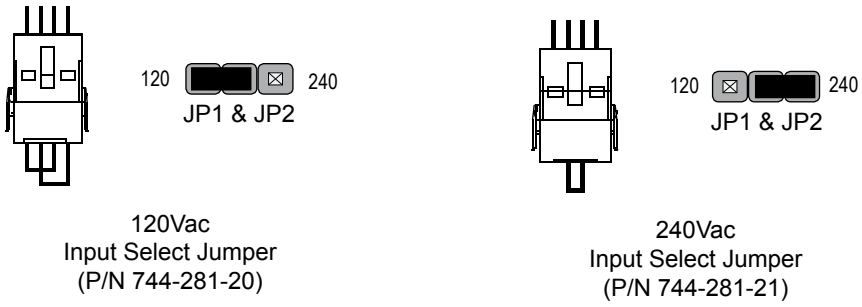


Fig. 3-4, Transformer Module Input Jumpers, PDB Jumpers

5. Remove the five front panel screws. Lift the transformer module front panel up and away from the chassis. The front handle and output fuse remain in place.
6. Reconfigure the PDB to 240Vac input, according to Table 3-2.
   - Change Switch 2-4 (SW2-4) to ON, Switch 2-5 (SW2-5) to OFF
   - Change Switch 2-6 (SW2-6) to ON, Jumper 1 (JP1) to Short (240) and Jumper 2 (JP2) to Short (240).

NOTE:

Only adjust positions SW2 -4, -5, -6. Do not adjust the other switch positions.

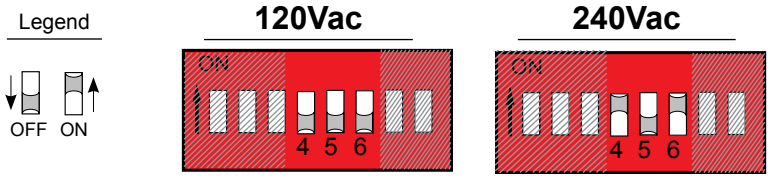


Fig. 3-5, SW2 Settings

7. Replace the front panel.
8. Install the power supply into the enclosure as outlined in Section 2.1 (Installation Procedure).

3.2.2 Reconfiguration from 240 to 120Vac

Tools Required:

- #2 Phillips head screwdriver
- Wire cutters and strippers
- Flat-blade screwdriver

Supplies Required:

120Vac 20A plug
(NEMA 5-20P, P/N 874-540-20)

120Vac Input Select Jumper
(P/N 744-281-20)

Contact your Alpha Technologies representative for Wire Set part numbers.

Procedure (240Vac Input to 120Vac Input):

1. Completely shut down the XM2 power supply. Remove all utility and battery power. Remove all connections and cables from the XM2 power supply.
2. Verify the enclosure system wiring before proceeding with power supply modification. Refer to the appropriate enclosure installation instructions.
3. Replace the 240Vac 15A plug (NEMA 6-15P) on the XM2 power supply input line cord with a 120Vac 20A plug (NEMA 5-20P). Verify proper wiring and ground on the new plug.

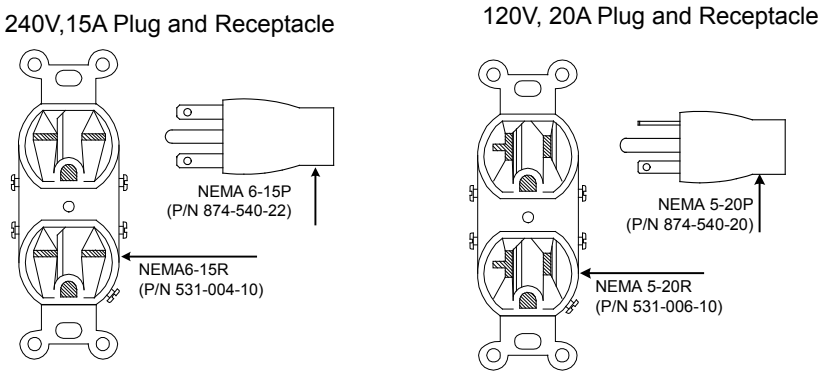


Fig. 3-6, Typical NEMA Receptacles and Plugs

4. Locate the transformer module input jumpers in the transformer compartment. Replace the currently installed 240Vac jumper (744-281-21) with a 120Vac jumper (744-281-20) and reconfigure JP1 and JP2 as shown below.

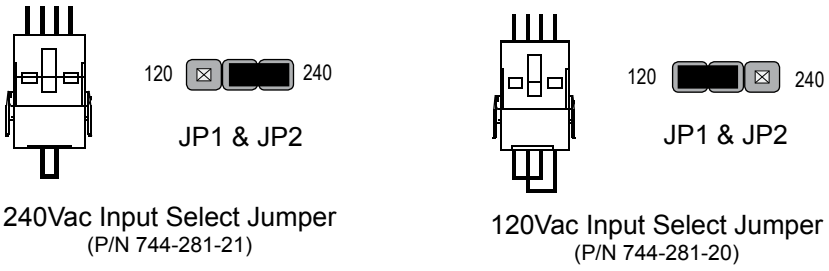


Fig. 3-7, Transformer Module Input Jumpers, PDB Jumpers

3.2 AC Input Voltage Reconfiguration, continued

3.2.2 Reconfiguration from 240Vac to 120Vac, continued

5. Remove the five front panel screws. Lift the transformer module front panel up and away from the chassis. The front handle and output fuse remain in place.

6. Reconfigure the PDB to 120Vac input, according to Table 3-2.
   - Change Switch 2-4 (SW2-4) to OFF, Switch 2-5 (SW2-5) to OFF
   - Change Switch 2-6 (SW2-6) to OFF, Jumper 1 (JP1) to Open (120) and Jumper 2 (JP2) to Open (120).

NOTE:

Positions of SW2 (-4, -5, -6) are shown for clarity. Do not adjust the other switch positions during this procedure.

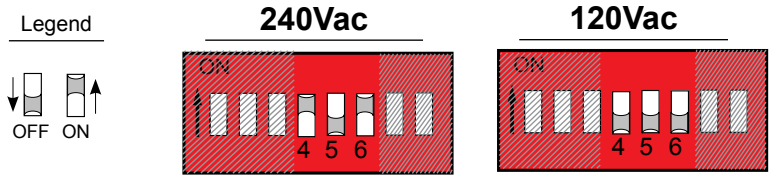


Fig. 3-8, SW2 Settings

7. Replace the front panel.

8. Install the power supply into the enclosure as outlined in Section 2.1, Installation Procedure.

3.3 AC Output Voltage Reconfiguration

The output voltage on many Intelligent CableUPS models (-906HP*, -910, -915, -918HP, -918HP, -922, -922HP, -924HP, -1350) can be easily reconfigured to provide an output voltage of 87, 75 or 63Vac, by moving a conveniently located OUTPUT TAP jumper and readjusting the DIP Switches on the PDB.

**63V or 87V only for the 906HP model.*

NOTE:

For the XM2-615A power supply, the OUTPUT TAP jumper enables the output voltage to be changed from 63Vac (default) to 48Vac only.

ATTENTION:

Only authorized personnel should reconfigure output voltage on the XM2 power supplies.

WARNING!

Before proceeding, remove *all* power from the power supply. Unplug the power supply from the AC power source, remove all front panel connections (i.e., N+1) and disconnect the battery connector. Failure to do so can expose the technician to potentially lethal voltages.

Tools Required:

- #2 Phillips head screwdriver
- Small flat-blade screwdriver

Output Voltage Reconfiguration Procedure:

1. Shut down the power supply, verify all power is removed and utility power is off and battery power is safely secured (or not installed) in the enclosure assembly. Remove all connections and cables from the power supply.
2. Remove the five front panel screws and lift the front panel up and away from the chassis. The front handle and output fuse remain in place.
3. Locate the transformer module's output connectors above the Power Distribution Board. Move the single black connector to the desired output voltage connector. Connectors are both labeled and color coded for easy identification (see Figs. 3-9, 3-10): Blue = 48Vac, Black = 87Vac (89Vac for HV model); White = 75Vac; and Red = 63Vac.

NOTE:

You must change the auto transformer fan input when the output voltage changes. In some cases the power rating and the output current settings may also need to be changed.

4. Reconfigure the PDB as required. Set the Output Voltage switches (SW1-2 and SW1-3) to reflect the same rating as the currently selected voltage on the Output Tap connector. Set the power rating switches (SW1-4 and SW1-5) and the output current switch (SW1-1) to the required setting.
5. Replace the front panel.
6. Install the unit into the enclosure as outlined in Section 2.1 (Installation Procedure).

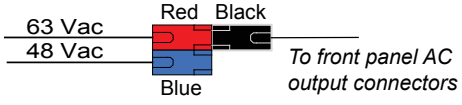


Fig. 3-9, XM2-615A Transformer Output Tap Connector shown in default setting (63Vac)

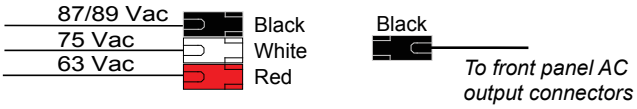


Fig. 3-10, Transformer Output Tap Connector for other CableUPS models

3.3 AC Output Voltage Reconfiguration, continued

3.3.1 Output Voltage Switch (SW1) Settings

Reconfiguration is a two-step process done while the power supply is switched OFF. Adjust the output tap connector, as well as the output voltage switch (SW1), and cycle the unit ON for the changes to be effective.

NOTE:

For purposes of clarity, only the adjustable positions of SW1 (-1, -2, -3, -4, -5) are highlighted. Do not adjust the other switch positions during this procedure.

Legend	Power Supply Output tap connector settings	
ON OFF	48Vac	63Vac
	63 Vac 48 Vac	63 Vac 48 Vac
Model	**Output Voltage Switch Setting**	
XM2-615A	ON 1 2 3 4 5	ON 1 2 3 4 5

Legend	Power Supply Output tap connector settings		
ON OFF	63Vac	75Vac	87/89Vac
	87/89 Vac 75 Vac 63 Vac	87/89 Vac 75 Vac 63 Vac	87/89 Vac 75 Vac 63 Vac
Model	**Output Voltage Switch Setting**		
XM2-906G6, XM2-906HP	ON 1 2 3 4 5	N/A	ON 1 2 3 4 5
XM2-910	ON 1 2 3 4 5	ON 1 2 3 4 5	ON 1 2 3 4 5
XM2-915, 915-E, M, P, XM2-915HV	ON 1 2 3 4 5	ON 1 2 3 4 5	ON 1 2 3 4 5
XM2-922, XM2-922HV *(240Vac only)*, XM2-924HP *(240Vac only)*	ON 1 2 3 4 5	ON 1 2 3 4 5	ON 1 2 3 4 5
XM2-1350 (36Vdc)	ON 1 2 3 4 5	ON 1 2 3 4 5	ON 1 2 3 4 5
XM2-1350 (48Vdc)	ON 1 2 3 4 5	ON 1 2 3 4 5	ON 1 2 3 4 5

Table 3-2, Output Voltage switch settings per Power Supply

3.3.1 Output Voltage Switch (SW1) Settings, continued

Reconfiguration is a two-step process done while the power supply is switched OFF. Adjust the output tap connector, as well as the output voltage switch (SW1), and cycle the unit ON for the changes to be effective.

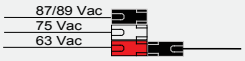
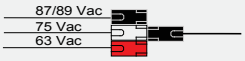
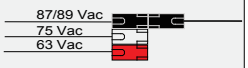
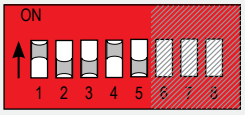
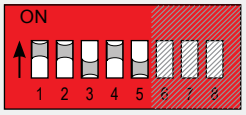
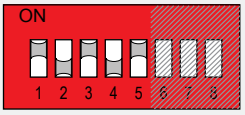
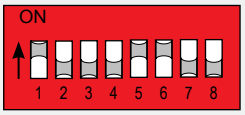
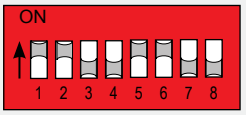
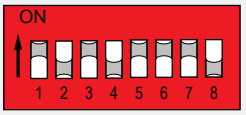
Legend	Power Supply Output tap connector settings		
ON OFF	63Vac	75Vac	87/89Vac
			
Model	**Output Voltage Switch Setting**		
XM2-918HP			
XM2-924HP			

Table 3-3, Output Voltage switch settings for XM2-918HP, XM2-924HP

4.0 Operation

4.1 Start-up and Test

4.1.1 AC Line Operation

1. Before making power supply connections, verify the correct voltage and frequency are available from the AC utility power source and voltage and polarity from the DC battery system.
2. Verify the AC circuit breaker (on the customer supplied service disconnect) and the battery breaker on the power supply are off.
3. Plug the power cord into the convenience outlet and the battery cable into the inverter module. Plug the RTS into the temp probe connection and attach it to the side of the center battery. Refer to Fig. 1-9. At this time, if an LRI is installed, connect it to the front panel connector labeled LRI.
4. Switch the AC (service disconnect) circuit breaker on to start initial power up. During this stage the power supply performs a “display test” and verifies configuration for the power supply. After the initial display test, a “No Batteries” alarm message appears in the Smart Display because the battery breaker is off. The green output LED remains off and the red alarm LED continues to flash while in this alarm state.

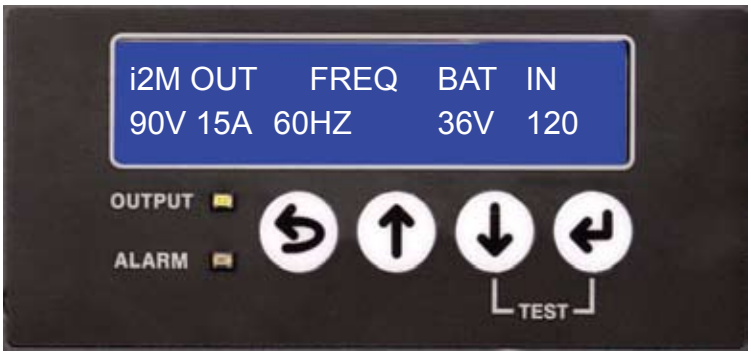


Fig. 4-1, Configuration Screen

NOTE:
Access the configuration screen any time by simultaneously pressing UP and ENTER.

4.1 Start-up and Test, continued

4.1.1 AC Line Operation, continued

5. Use the Smart Display to verify XM2 power supply operations. If desired, the No Battery alarm can be disabled by changing Battery Capacity to “0” in the setup menu.

6. Use the Smart Display to verify AC output (±5%).

Setting	Low (-5%)	High (+5%)
89Vac (HV)	85.4Vac	92.5Vac
87Vac	82.65Vac	91.35Vac
75Vac	71.25Vac	78.75Vac
63Vac	59.85Vac	66.15Vac
48Vac	45.6Vac	50.40Vac

Table 4-1, AC Output

7. Switch on the battery breaker. Within one minute the flashing red alarm LED turns off, the green output LED turns on, the No Battery alarm clears and the power supply resumes Operation Normals. Use the Smart Display to verify operations and setup as needed.

4.1.2 Self Test Operation

1. The power supply should be operating correctly with no alarms present. Use the Smart Display to verify Normal and Communication Information. Verify test duration in the Setup Menu as needed.

2. Press and hold DOWN and ENTER simultaneously to start Self Test. The test will run for a preset time (5-180 minutes, set in the Setup Menu). Self Test can also be entered by setting Self Test to ON in the Setup Menu.

3. While in self test mode, use the Smart Display or a true RMS voltmeter to verify output at the module’s AC Output test point (legacy models only). Output voltages should appear within ±5% of: 89Vac for HV models, 87Vac for 90V units, 75Vac for 75V units and 63Vac for 60V units, at nominal line input voltage. In the case of an XM2-615A that has been set for 48Vac output, the measured output voltage should be ±5% of 48Vac. See Table 4-1.

4. To cancel a self test in progress, push and hold DOWN and ENTER a second time or change Self Test to OFF in the Setup Menu.

4.1.3 Standby Operation

Perform the following procedure after successful completion of a self test with the CableUPS operating normally in AC line mode.

1. Momentarily fail the AC utility input power by switching the AC (service disconnect) circuit breaker to OFF.

2. The power supply starts operating in the inverter mode. Use the Smart Display or a true RMS voltmeter to verify output. Output voltages should appear within ±5% of: 89Vac for HV models, 87Vac for 90V units, 75Vac for 75V units and 63Vac for 60V units, at nominal line input voltage. In the case of an XM2-615A that has been set for 48Vac output, the measured output voltage should be ±5% of 48Vac. See Table 4-1.

3. Return the power supply to AC Line mode by switching the AC (service disconnect) circuit breaker to ON. The transfer back to utility power may take 10 to 50 seconds for the utility voltage and frequency to stabilize, and the module's phase-lock circuitry to activate. The module then synchronizes the inverter's waveforms before initiating a smooth, in-phase transfer back to utility power. Once the transfer is complete, the Smart Display reports: OPER MODE = LINE.

The CableUPS is now fully operational.

4.2 Using the Smart Display

All operational functions, system testing, setup menus and alarms are available via the illuminated display panel on the front of the CableUPS. Display functions are accessible by pressing any of the four keys: ESCAPE, UP, DOWN and ENTER.

Descriptions of the key functions areas follows:

Icon	Function
Escape	Move up one level in the menu tree. Leave the EDIT mode without saving the changes made to the selected menu item.
Up	Scroll up in a branch of the menu tree. Increase a parameter (or value) while in the EDIT mode.
Down	Scroll down in a branch of the menu tree. Decrease a parameter (or value) while in the EDIT mode.
ENTER	Displays the next lower level in the menu tree. In the EDIT mode, ENTER accepts the new value into memory. Pressing ENTER for two seconds or longer initiates Display Test mode. Display Test mode switches all LED and LCD pixels (dots) on for several seconds.
+ Self-test	Press DOWN and ENTER simultaneously to manually enter self test mode. A self test will be initiated and run between 5-180 minutes (set in the setup menu). To cancel a self test in progress, simultaneously press DOWN and ENTER.
+	The operator can view the Configuration screen by pressing UP and ENTER together.

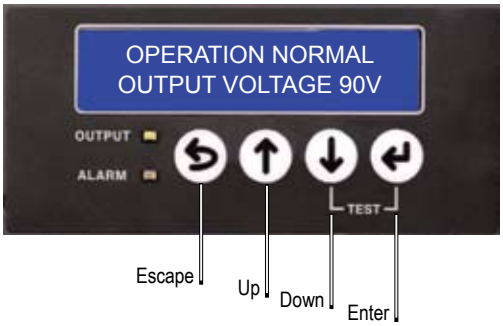


Fig. 4-2, Smart Display Navigation

4.2 Using the Smart Display, continued

Display Backlighting

The display is normally unlit. Press any key once to activate backlighting and illuminate the display without deactivating Auto Scroll.

Auto Scroll

The display is normally in Auto Scroll mode, continually cycling through the sub-menu items at a two-second interval. In Auto Scroll mode you can quickly view menu items without the need to press any keys.

Single Step

Pressing either arrow key activates Single Step mode in which you can step through individual menu items one at a time. Each press of the arrow key steps up or down through the sub-menu items. Press ESC to return to Auto Scroll mode.

Fig. 4-3, Smart Display Panel

Direction Indicator Symbols

The rightmost character of the display (may appear on either line) indicates the proper key function when manually scrolling. Where more than one choice is available multiple characters display. Possible characters or text are:

↕ Access more menu items by pressing either the UP or DOWN arrow keys.

↵ Use the ENTER key to select this function.

↩ Use the ESCAPE key to leave the selected function without altering any values or to go to back to the previous menu in the display.

↑ ↓ Press UP or DOWN arrows to change a display value or mode.

↩ Press ESCAPE to leave this menu item without making any changes (and go back to the previous menu).

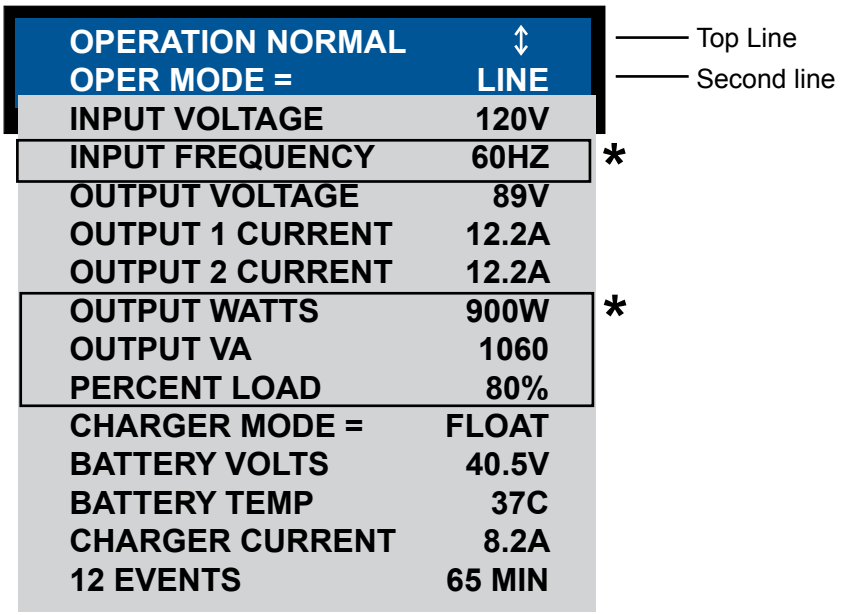
↵ Press ENTER to save the change into memory. This type of multiple display choice is normally available in the programming mode.

4.3 Smart Display Modes

4.3.1 Operation Normal

If no alarms are present, the power supply operates in Operation Normal display mode. In this mode you can view the primary operating parameters of the power supply while the display auto scrolls through the available menu items at two-second intervals. In Operation Normal mode the displayed items are all “metered” items and are for informational purposes only (not programmable) with respect to the operational status of the power supply.

The Operation Normal menu contains the following items:



***Only visible in single-step mode**

Fig. 4-4, Operation Normal Display
(Examples are given for values in the display)

The top line indicates the current screen and provides additional instructions. Use the arrows to manually scroll.

The second line cycles through the parameters listed above.

4.3.2 Comms Information Display (with DSM2 or later)

Pressing ENTER while in the Operation Normal screen will open the Comms Information display (only displayed when paired with suitable communications module, otherwise display will read “NO DATA”). This mode operates in a similar fashion as the Operation Normal display. When you first access the information display, information displays in Auto Scroll mode. Press UP or DOWN to access information one step at a time. Press ENTER to access the Setup Menu (discussed in Section 4.3.3, Setup Menu). Press ESCAPE to reactivate Auto Scroll mode. Press ESCAPE a second time to reactivate Operation Normal mode (up one level).

The Comms Information display contains the following items:

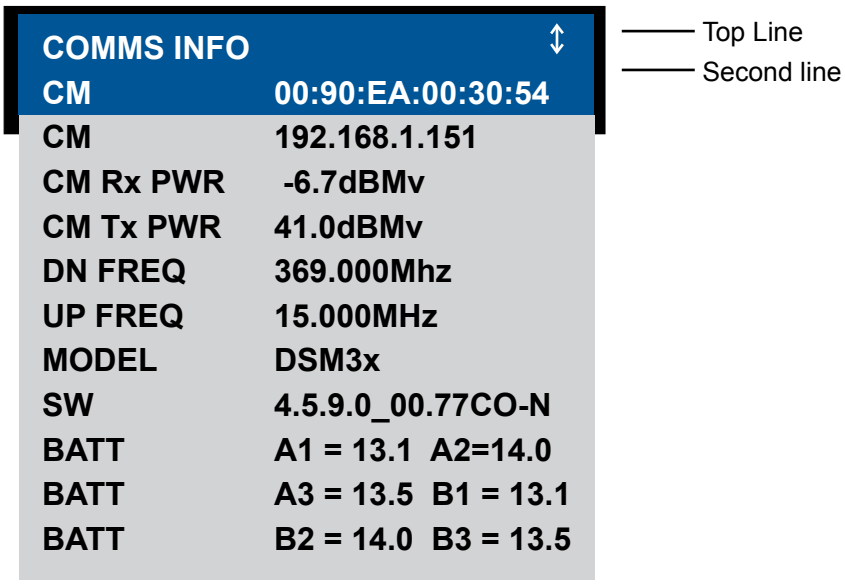


Fig. 4-5, Comms Information Display
(Examples are given for values in the display)

The top line provides additional instructions. Use the arrows to manually scroll.

The second line cycles through the parameters listed above.

4.3.3 Setup Menu

Pressing ENTER while in the Comms Status display opens the Setup Menu, one level below the Comms Status display. Using the Setup menu you can view and change the programmable operating parameters of the power supply or the optional PIM. Setup Menu navigation is similar to the Operation Normal menu. Press UP or DOWN to access the Single Step mode where sub-menu items are individually selected.

To select and change a value in the Setup Menu:

1. Press either UP or DOWN to put the display in the Manual Scroll mode.
2. Continue to press UP or DOWN until the desired item is displayed.
3. Press ENTER to select the item for editing.
4. Use UP to increase the displayed value or DOWN to decrease the value. To change the displayed value more rapidly, press and hold either UP or DOWN for more than two seconds while in edit mode.

NOTE:
When in EDIT mode, press the ENTER key twice for the change in the parameter to take effect.

5. Press ENTER when the desired value displays. This accesses an additional display where you can either ESCAPE from programming mode and not save the new value or press ENTER to accept and save the new value.
6. After the value is saved, the display returns to the Setup Menu. You may now check and view the new value or select additional parameters to modify.

If an incorrect value is entered, repeat the above process and enter the proper value; or select the Set Defaults menu selection on the Setup Menu and press ENTER twice to reset all parameters to their factory default values.

In addition to using UP and DOWN to increase or decrease numerical values, you can select ON or OFF and YES or NO in the same manner as described. The CODE VER, XM_CLASS VER and Total Run Time selections are for informational display only and cannot be edited. To return to the “Operation Normal” menu from the Setup Menu, press ESCAPE three times.

NOTE:
The Set Defaults menu selection does not reset Standby Time, Standby Events or Device Address; you must manually reset these settings.

4.3 Smart Display Modes, continued

4.3.3 Setup Menu, continued

The Setup Menu contains the following items:

Top Line (provides additional information)

- SET UP MENU
- ↓↑ TO MANUAL SCROLL
- <ESC> TO COMMS INFO

Second Line (cycles through the following parameters):

	Default	Minimum	Maximum
Other Battery Types	Other	If AlphaCell™ is selected then user selects between a range of Alpha cells	
Float V/C	2.27 V/C	2.10 V/C	2.35 V/C
Accept V/C	2.40 V/C	2.20 V/C	2.45 V/C
Temp Comp	5.0 mV	0.0 mV	5.0 mV
Batt. Capacity*	100 AH	0	1000 AH
Standby Time	0	0	65335
Standby Events	0	0	65335
Total Runtime	0	0	65335
Self Test	Off	Off	Yes
Test Inhibit	—	7 Days	7 Days
Test Interval	30 Days	0 Days	360 Days
Test Duration	10 Min	5 Min	180 Min
Test Countdown	0	0	365 Days
Freq. Range	3.0Hz	1.0Hz	6.0Hz
Tap Switch**	No	No	Yes
PIM Option	Yes	No	Yes
Reset Output 1	—	No	Yes
Reset Output 2	—	No	Yes
Over Curr1	—	3.0 A	24 A
Over Curr2	—	3.0 A	24 A
Retry Delay	60 Sec	5 Sec	301 Sec
Retry Limit	20	0	40
Over Curr Tol	3000ms	20ms	9000ms
N+1 Valid	No	No	Yes
Set Defaults	—	No	Yes
Language	English	Spanish/French/Portuguese/German	

These items appear in the setup menu only if battery type ***Other*** is selected. They are preset (but not displayed) if AlphaCell™ is selected.

These items appear in the setup menu only if the optional PIM is installed.

* 100Ah = 1 battery string, 200Ah = 2 battery strings, 300Ah = 3 battery strings

* * Feature not available in US

NOTE:

See Section 4.6 Smart Display Glossary for descriptions of setup menu parameters.

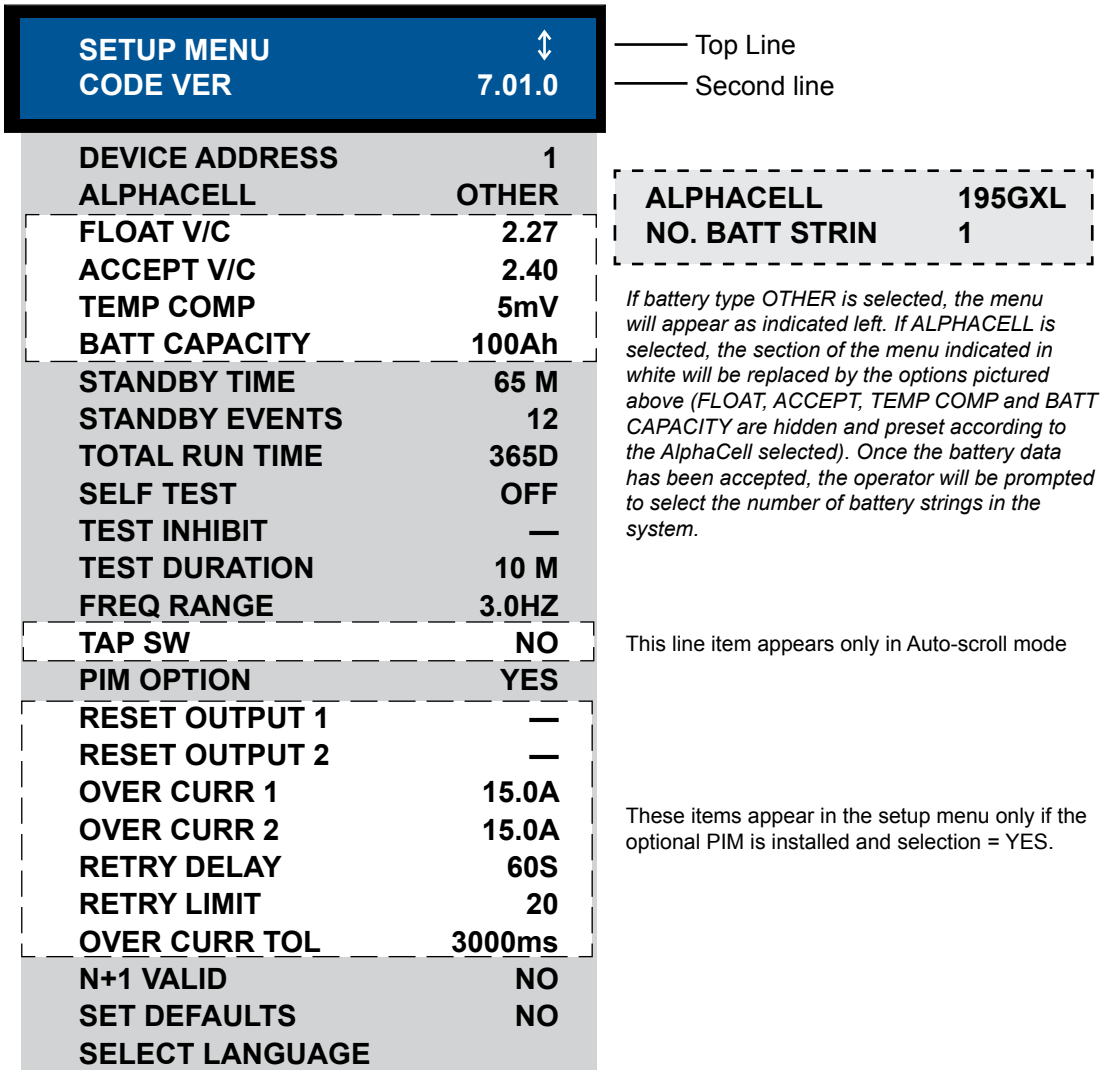
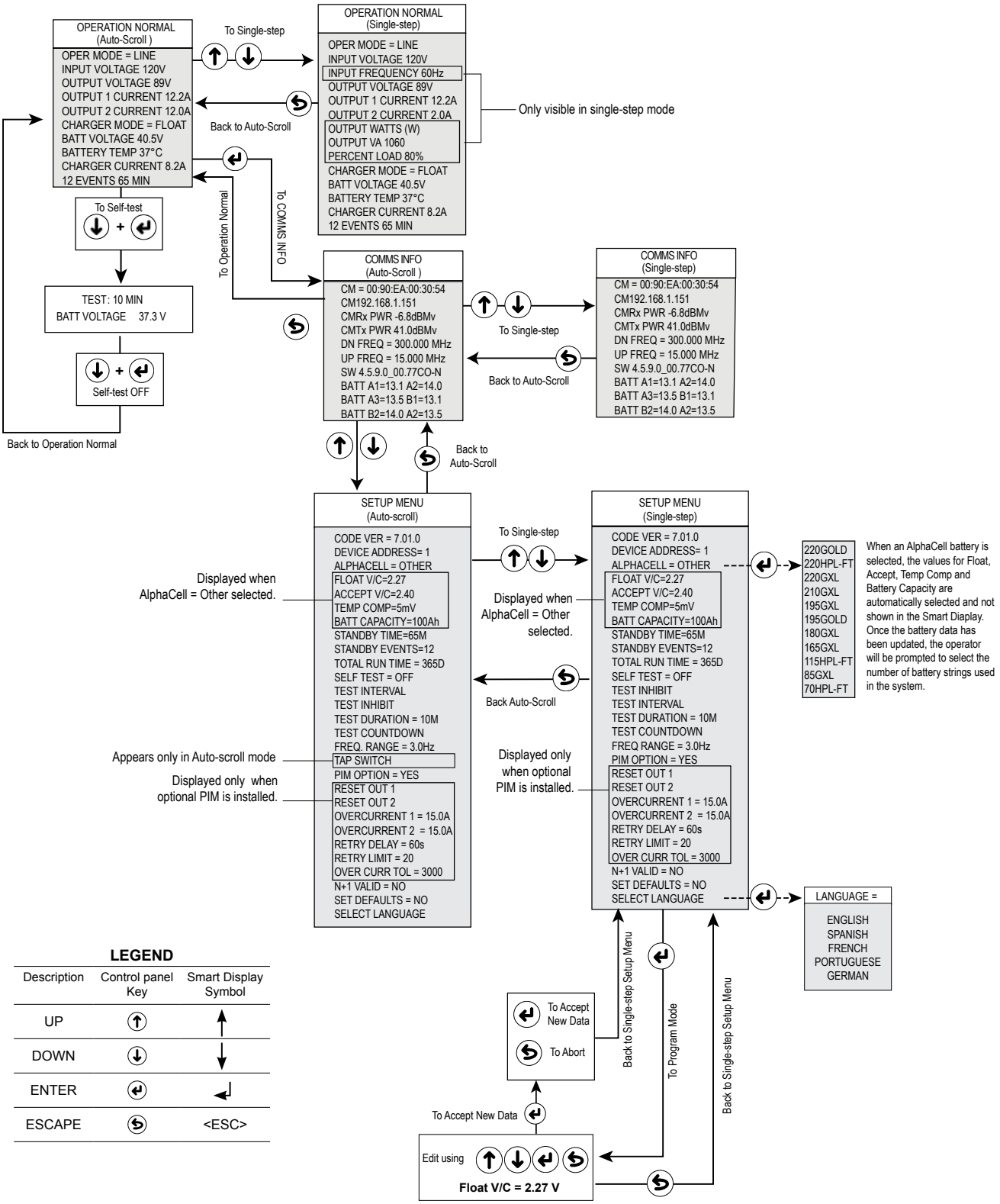

SETUP MENU ↕
CODE VER 7.01.0
Top Line
Second line
DEVICE ADDRESS 1
ALPHACELL OTHER
FLOAT V/C 2.27
ACCEPT V/C 2.40
TEMP COMP 5mV
BATT CAPACITY 100Ah
STANDBY TIME 65 M
STANDBY EVENTS 12
TOTAL RUN TIME 365D
SELF TEST OFF
TEST INHIBIT —
TEST DURATION 10 M
FREQ RANGE 3.0HZ
TAP SW NO
PIM OPTION YES
RESET OUTPUT 1 —
RESET OUTPUT 2 —
OVER CURR 1 15.0A
OVER CURR 2 15.0A
RETRY DELAY 60S
RETRY LIMIT 20
OVER CURR TOL 3000ms
N+1 VALID NO
SET DEFAULTS NO
SELECT LANGUAGE
ALPHACELL 195GXL
NO. BATT STRIN 1
If battery type OTHER is selected, the menu will appear as indicated left. If ALPHACELL is selected, the section of the menu indicated in white will be replaced by the options pictured above (FLOAT, ACCEPT, TEMP COMP and BATT CAPACITY are hidden and preset according to the AlphaCell selected). Once the battery data has been accepted, the operator will be prompted to select the number of battery strings in the system.
This line item appears only in Auto-scroll mode
These items appear in the setup menu only if the optional PIM is installed and selection = YES.

Fig. 4-6, Setup Menu Display
(Examples are given for values in the display)

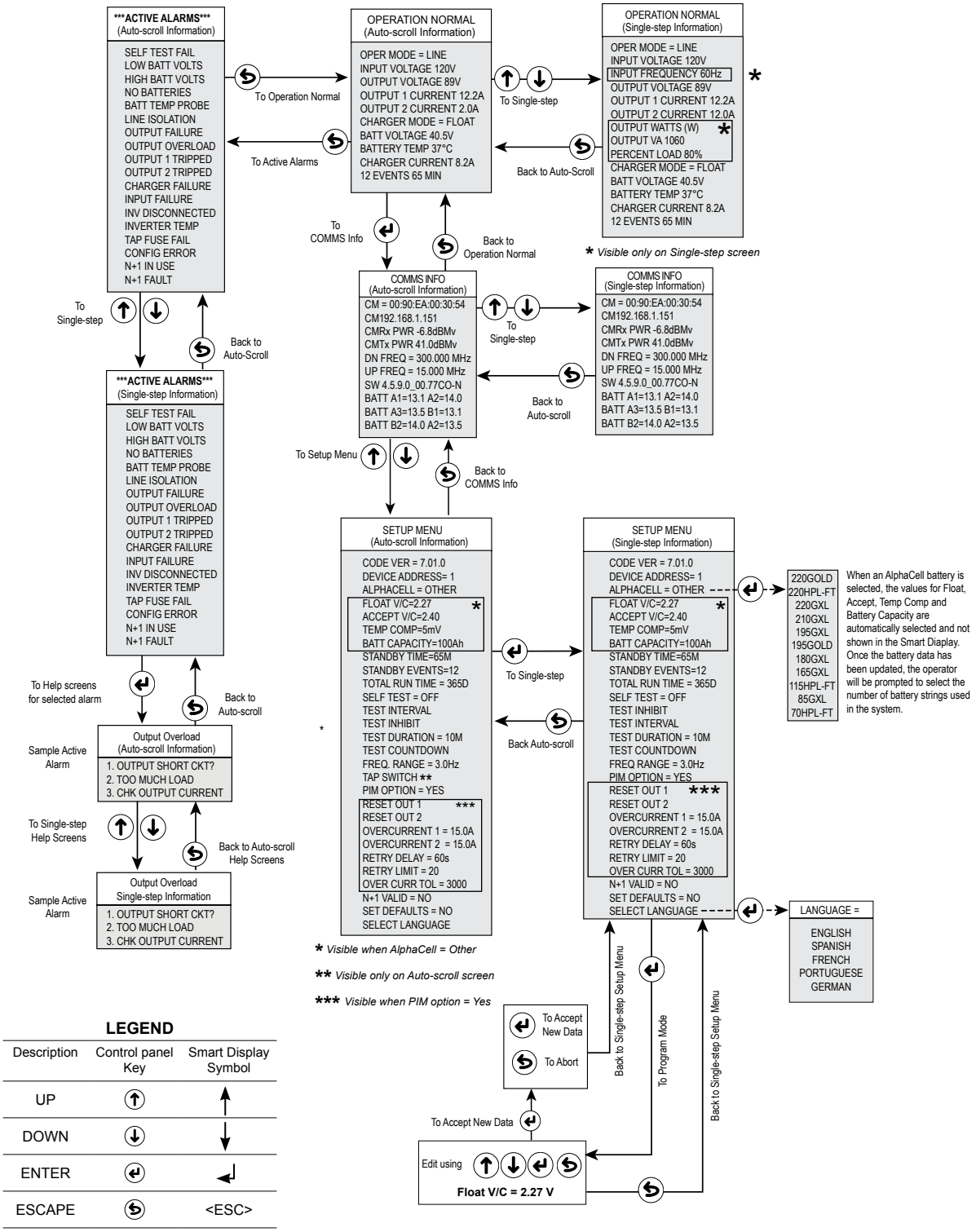
4.3 Smart Display Modes, continued

4.3.4 Menu Structure/Navigation (from Operation Normal screen)



4.3 Smart Display Modes, continued

4.3.5 Menu Structure/Navigation (from Active Alarms screen)



4.4 Alarm Indications

In the event of a failure, the Active Alarm displays which alarms are active and how to correct the alarm condition. Major alarms cause the red LED to flash.

- Press UP or DOWN to stop Auto Scroll. Arrows on the right-hand side of the display text indicate which keys to press to display the next menu item.
- Press UP or DOWN to select the alarm of interest.
- Press ENTER to select the alarm and display diagnostic information. Press ESCAPE to return to the alarm list.

NOTE:

If only one alarm is active, the alarm list is bypassed and diagnostic information for the single active alarm displays.

A Help sub-menu provides possible remedies relating to the active alarm. To access the Active Alarm Help sub-menu, scroll to the alarm of interest and press ENTER. The diagnostic information initially auto scrolls. To enter manual scroll mode, press either UP or DOWN. Press DOWN to scroll through the list of remedies.

Alarms are classified in two categories:

MAJOR Alarms are indications of a serious failure within the CableUPS, such as a loss of output voltage or a failed battery charger. Any situation that causes output failure is considered a Major Alarm. Major alarms require immediate action to correct the failure. To correct major alarms, follow the Smart Display on-screen instructions.

MINOR Alarms indicate a less serious failure, such as defective RTS or loss of utility power. Corrective action can be delayed for a short time. To correct, follow the Smart Display on-screen instructions.

The alarm matrices on the following pages indicate the MAJOR/MINOR active alarms, the probable cause and troubleshooting items to check to correct the alarm condition.

4.4 Alarm Indications, continued

Active Alarm or Abnormal Condition	Probable Causes	Corrective Action
Self Test Fail *(see Note 1 below)*	36 Volt battery string below 33.0 Vdc 48 Volt battery string below 44.0 Vdc Alarm during a Self-Test Inverter failure has occurred Line Isolation Alarm	1. Check/correct other alarms. 2. Check that correct AC Input Voltage is present 3. Check Battery Circuit Breaker 4. Check Battery Fuse, if installed 5. Check Battery condition and voltage 6. In the event that a Self Test Alarm condition was already present, re-run the Self Test to clear the alarm. 7. Change Inverter Module 8. Replace Power Supply
Config Error	Configuration Switch Settings Incorrect Power Distribution Board failure *(see Note 2 below)*	1. Check the configuration switch & jumper settings on the Power Distribution Board match those required for the power supply. 2. Verify the configuration settings on display (press UP and Enter simultaneously) match the application and configuration switch settings on the Power Distribution Board. 3. Check transformer Output Tap setting to verify the Inverter Module voltage matches the Transformer Module voltage and voltage shown on the label of the Inverter Module matches the voltage of Transformer Module. 4. Check for corrosion on the Power Distribution Board. 5. Verify Power Distribution Board to Inverter Module Ribbon Cable and Connectors are properly connected. 6. Turn all power off, wait 10 seconds, turn all power back on. 7. Change Inverter Module 8. Replace power supply.
Tap Fuse Fail	Open ATS fuse *(see Note 3 below)* ATS damage Power Distribution Board damage *(see Note 2 below)*	1. Check/replace fuse on ATS 2. Check for damaged contacts on the ATS board relay. 3. Check the configuration switch settings on the Power Distribution Board match those required for the power supply. 4. Check that configuration settings on display (press UP and Enter simultaneously) match the configuration switch settings on the Power Distribution Board. 5. Turn all power off, wait 10 seconds, turn all power back on. 6. Replace power supply

NOTE:

Note 1: To clear a Latched Self-Test Fail Alarm, initiate and complete a successful self-test.

Note 2: Remove and replace power supply. **Do not try to clear alarm or replace relay while in service**.

Note 3: The Automatic Tap Switch (ATS) option is not available in units sold in North America or Europe.

4.4 Alarm Indications, continued

Active Alarm or Abnormal Condition	Probable Causes	Corrective Action
Output Overvoltage Reading	Configuration error Failure of metering circuit on Power Distribution Board Failure of Transformer	1. Check output voltage and compare to display reading: 2. Check the configuration switch settings on the Power Distribution Board match those required for the power supply. 3. Check that configuration settings on display (press UP and Enter simultaneously) match the configuration switch settings on the Power Distribution Board. 4. Check Output Taps from Transformer. 5. Change inverter module 6. Replace power supply
Line Isolation Alarm	Failure of input relay	1. Open the Battery Circuit Breaker 2. Pull out and re-seat Inverter Module 3. Turn the Battery Circuit Breaker back on. 4. Run Self Test (press Down and Enter simultaneously). 5. If Alarm…..Replace power supply
Output Failure Alarm	Battery End of Discharge during Line Input Fail Configuration Settings incorrect Output overloaded Output in short circuit	1. Check for AC Input Voltage present 2. Check Output current on the display. If Output Current is > 100% of rating, correct overload conditions. 3. Measure the output voltage and compare to the display output voltage 4. Check Output Taps from Transformer. 5. Check the configuration switch settings on the Power Distribution Board match those required for the power supply. 6. Check that configuration settings on display (press UP and Enter simultaneously) match the configuration switch settings on the Power Distribution Board. 7. Open the Battery Circuit Breaker and 8. Pull out and re-seat Inverter Module 9. Turn the Battery Circuit Breaker back on. 10. Replace power supply
Battery Temp Probe Alarm	Temperature Sensor Failure or Inverter Board Failure	1. Inspect RTS sensor, wire and connector to see if there is an intermittent connection 2. Replace with known good sensor 3. Check Battery Temperature Display Reading 4. Check for Alarm 5. Replace Inverter Module

4.4 Alarm Indications, continued

Active Alarm or Abnormal Condition	Probable Causes of Alarm	Corrective Action
Low Batt Volts	Bad Batteries or 36 Volt battery string below 33.0 Vdc or 48 Volt battery string below 44.0 Vdc, Inverter Module not seated or AC Input Fail or Inverter Module Failure	1. Check Battery Voltage and compare to Displayed Battery Voltage 2. Check for correct battery capacity on Set-up Menu. 3. Check for AC Input Voltage present 4. Open the Battery Circuit Breaker and 5. Pull out the Inverter Module 6. Verify Inverter Module securely connected. 7. Re-seat the Inverter Module 8. Turn the Battery Circuit Breaker back on. 9. Replace Inverter Module
High Batt Volts	36 Volt battery string above 45.0Vdc or, 48V battery string above 60.0Vdc	1. Check Charger settings.
No Batteries	Detected the absence of batteries (alarm inactive when battery capacity set to 0)	1. Check Battery breaker 2. Check Connections 3. Check battery Fuse

Active Alarm or Abnormal Condition	Alarm States		Corrective Action
Output Overload *(XM2)*	**Overload Indication**	**Current Range** *(approx. %)*	1. Check Output current on the display. If Output Current is > 100% of rating, correct overload conditions. 2. Check the configuration switch settings on the Power Distribution Board match those required for the power supply. 3. Turn all power off, wait 10 seconds, turn all power back on. 4. Check that configuration settings on display (press UP and Enter simultaneously) match the configuration switch settings on the Power Distribution Board. 5. If PIM option installed, check PIM limits on display 6. Replace Inverter Module 7. Replace power supply
	Alarm, no shutdown	110 to 115%	
	Alarm, shutdown in 30m	115 to 125%	
	Alarm, shutdown in 10m	125 to 150%	
	Alarm, shutdown in 30s	>150%	
	Alarm, shutdown in <15s	Short circuit	

4.4 Alarm Indications, continued

Active Alarm or Abnormal Condition	Alarm States		Corrective Action
Output Overload *(XM2-918 HP, XM2-924HP)*	**Overload Indication**	**Current Range** (approx. %)	1. Check Output current on the display. If Output Current is > 100% of rating, correct overload conditions. 2. Check the configuration switch settings on the Power Distribution Board match those required for the power supply. 3. Turn all power off, wait 10 seconds, turn all power back on. 4. Check that configuration settings on display (press UP and Enter simultaneously) match the configuration switch settings on the Power Distribution Board. 5. If PIM option installed, check PIM limits on display 6. Replace Inverter Module 7. Replace power supply
	Alarm, no shutdown	105 to 107.5%	
	Alarm, shutdown in 30m	107.5 to 112.5%	
	Alarm, shutdown in 10m	112.5 to 125%	
	Alarm, shutdown in 30s	>125%	
	Alarm, shutdown in <15	Short circuit	

Active Alarm or Abnormal Condition	Corrective Action	Probable Cause of Alarm
Batt Temp Probe	1. Check Connection 2. Check Sensor	Remote Temp Sensor (RTS) failed or is not connected
Input Failure	1. Utility Failure 2. Circuit breaker input 3. Input Connections 4. Check 120/240 Jumpers	Utility AC Input has failed
N+1 In Use	1. Check Output Fuse 2. Check Output Connections	Output of CableUPS has failed. Load has been transferred to N+1 unit
N+1 Fault	1. Verify wiring 2. Check N+1 output	Input voltage was expected on N+1 unit; none detected.

4.4 Alarm Indications, continued

Active Alarm or Abnormal Condition	Probable Causes	Corrective Action
Output 1 Tripped	Output 1 hardware protection mode engaged (only active with optional PIM installed)	1. Over Current 2. Check Settings
Output 1 Tripped	Output 1 hardware protection mode engaged (only active with optional PIM installed)	1. Over Current 2. Check Settings
Charger Failure Alarm	Bad batteries Inverter Module not seated Inverter Module failure?	1. Open the Battery Circuit Breaker, 2. Verify the Display is still on. 3. If Display drops out…. 4. Pull out the Inverter Module 5. Inspect the Inverter Module and rear Anderson connectors. 6. Re-seat the Inverter Module 7. Turn the Battery Circuit Breaker back on. 8. Check charging current on display. 9. Run Self Test (press Down and Enter simultaneously). 10. Check Battery Voltage. 11. Check Battery physical condition. 12. Wait a minimum of three hours. 13. Check Battery Voltage again. 14. Verify Battery Voltage has increased (Battery charging) and Alarm has not returned. 15. Replace Inverter Module
Inverter Disconnected	The Inverter Module is not properly connected	1. Reseat Inverter Module 2. Check Ribbon Cable
Inverter Temperature	Inverter heatsink has exceeded set temperature (Standby operations suspended until temperature drops to safe level).	1. Check Fan 2. Check Filter (legacy models)

4.5 Smart Display LEDs

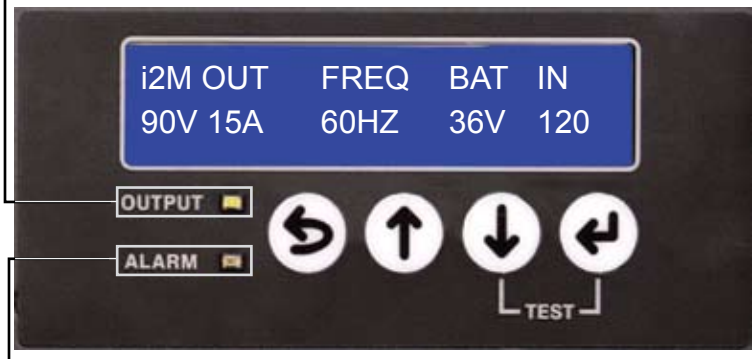
Two LEDs on the Smart Display indicate the condition and status of the Intelligent CableUPS.

The green Output LED, when lit, indicates the power supply is functioning normally and supplying output AC to the load. A flashing output LED indicates that a minor alarm has been detected. If the Output LED is off, a major alarm has been detected.

The red Alarm LED flashes to indicate a major alarm has been detected. This state clears when the alarm is no longer present. Under typical operating situations, the red Alarm LED is off. This indicates normal power supply operation.

OUTPUT LED (green)

SOLID = Operation Normal
FLASHING = Minor Alarm
OFF = Major Alarm



ALARM LED (red)

FLASHING = Major Alarm
OFF = Minor Alarm
OFF = Operation Normal

Fig. 4-7, Output and Alarm LEDs

4.6 Smart Display Glossary

Battery Capacity: The capacity of the battery strings attached to a particular Intelligent CableUPS. When batteries are not attached, the setting must be programmed to “0.” This disables standby operations, including test mode and disables the No Batteries Alarm. If batteries are attached, then this setting should be programmed to the total rating of all the battery strings. This setting can be programmed to higher values to accommodate multiple battery strings (i.e., 1 battery string = 100 AH, 2 battery strings = 200 AH, 3 battery strings = 300 AH. 4 battery strings = 400AH).

NOTE:

If the power supply is used in a non-standby application, this variable must be programmed to “0” to disable the battery maintenance cycle portion of a self test.

Charger Accept Voltage: Battery Accept charge voltage control in volts per cell. This voltage, 2.40Vdc (adjustable) per cell, is temperature compensated to ensure longer battery life. It properly completes the charge cycle and is factory set for AlphaCell batteries. If another manufacturer’s batteries are used, consult the battery manufacturer for Accept voltage levels.

Charger Float Voltage: Battery Float charge voltage control in volts per cell. The average is approximately 2.27Vdc (adjustable) per cell. It is factory set for AlphaCell batteries. If another manufacturer’s batteries are used, consult the battery manufacturer for Float voltage levels.

Charger Temperature Compensation: Battery charger temperature compensation control. Programming this parameter to “0.0” disables temperature compensation. It is factory set for AlphaCell batteries (5mV/cell). If another manufacturer’s batteries are used, consult the battery manufacturer for Charger Temperature compensation ranges.

Device Address: The power supply must have a unique address to communicate with a system controller. The system controller uses the address as an identifier to query the power supply for information. Each power supply on the same communications bus must be identified with a value between 1 and 7.

NOTE:

The device address does not reset to 1 when factory defaults are reset.

End of Battery Discharge (EOD): The point at which the batteries are fully discharged (default 1.75V/C * 18 cells for 36V inverter) and the power supply shuts off, preventing permanent damage to the batteries.

Frequency Range Limit (may be used when powering with AC Generator): AC input voltage frequency range limit. This limit establishes the acceptable input frequency range outside of which standby operation is initiated.

Output 1 Overcurrent Trip level — *Primary leg:* Value of RMS current that causes an overcurrent trip on the Output 1A + Output 1B protection relay after a specified delay. This limit is linked to counter data item Overcurrent Tolerance Period. This parameter is only visible when the Protective Interface Module (PIM) is attached.

Output 2 Overcurrent Trip level — *Secondary leg:* Value of RMS current that causes an overcurrent trip on the Output 2 protection relay after a specified delay. This limit is linked to counter data item Overcurrent Tolerances Period. This parameter is only visible when the optional PIM is attached.

Battery Type: (HP models only) The AlphaCell battery type can be specified in the smart display (if not AlphaCell, leave as default battery type, Other). If AlphaCell is selected, Accept, Float, Temp, Comp and Battery Capacity is automatically selected. If Other, these parameters will need to be manually set to the manufacturer’s recommended rating.

NOTE:

If AlphaCell is selected, Accept, Float, Temperature Compensation and Battery Capacity are not displayed.

4.6 Smart Display Glossary, continued

Overcurrent Tolerance Period: An output overcurrent condition is tolerated on either of the PIM outputs for this amount of time. When this delay expires, the output protection relay disables the output. This parameter is only visible when a PIM is installed.

Reset Output 1, Reset Output 2: Programming this feature resets the corresponding output in the event one or both outputs are tripped. Upon clearing the alarm, either manually or via an automatic retry, the output(s) remain on. This parameter is only visible when a PIM is installed.

Retry Delay: PIM option output fault retry interval timer. This is the period of time between each attempt to restart an output connection. A value greater than 600 seconds disables the automatic retry function. This parameter is only visible when a PIM is installed.

Retry Limit: PIM fault retry count limit. This is the number of times the unit will attempt to restart an output connection at the frequency specified by Retry Delay. Once the retry limit is exceeded, attempts to restart the feeder occur indefinitely, once every 30 minutes. This parameter is only visible when a PIM is installed.

Set Defaults: When programmed to YES, all the programmable data levels (except DEVICE ADDRESS) are reset to the original factory settings.

Self Test: When programmed to YES, the CableUPS automatically starts a self test.

Standby Events: A standby events counter. This does not include self test events. Use the Setup Menu to reset Standby Events to zero.

Standby Time: The total amount of time the power supply has operated in standby mode. This does not include self test time and represents the sum total number of minutes of AC line failure since the last time the counter was reset. Use the Setup Menu to reset Standby Time to zero.

NOTE:

Resetting factory defaults does not clear Standby Events or Standby Time.

Test Countdown: The number of days remaining before the next scheduled automatic self-test initiates. This variable is programmable and you can select the day the autotest sequence will begin. This counter has no effect if test interval is set to 0.

Test Duration: Automatic self test duration timer. This sets the number of minutes of a battery maintenance cycle test. This timer applies to automatically or manually initiated tests.

Test Inhibit: Becomes active when programmed by the operator (or when the unit runs in inverter mode for more than 5 minutes). The power supply delays the start of a scheduled self test for seven days if the test countdown is less than seven days (See Section 4.4, Automatic Performance Test for complete details).

Test Interval: Automatic self test control timer. The number of days between battery maintenance cycle tests. Set this value to zero to disable automatic self test.

Total Run Time: The amount of time (in days) the power supply has functioned in any mode of operation. This is not a resetable value.

4.7 Automatic Performance Test

Automatic Self-Test: An automatic self test can be periodically performed to verify the state of the batteries and the inverter circuitry. The automatic test feature has several programmable parameters that determine the frequency and duration of automatic tests. In addition to automatic testing, the operator can manually initiate a self-test by pressing ENTER and DOWN simultaneously. A running test may be halted manually by pressing ENTER and DOWN a second time.

The test sequence process:

- Begins with a check to verify the batteries are attached and the battery circuit breaker is closed. If the batteries are discharged or not connected, the power supply does not attempt to operate in inverter mode, preventing a drop of the load.
- Next, the power supply switches to standby mode for a pre-programmed period. Successful completion of a test sequence indicates the unit is operating normally in standby mode, the battery voltage did not drop below a preset threshold and the output was stable throughout the test. Failure of test is indicated by a Self-Test Fail alarm, which can be cleared by subsequently running a successful test for at least one minute.

Test Control: Initiate a manual test (or a running test may be halted) at any time by pressing ENTER and DOWN simultaneously or by changing the Self-Test switch via the front panel interface or status communications. A self-test may also be initiated via the status monitoring card.

To prevent an automatic test scheduled to occur in the next week, issue a Test Inhibit command. This command is useful if periodic maintenance of the power supply is scheduled close to the next scheduled automatic test.

This control feature may also be used when inclement weather is expected that might cause a utility failure. The Test Inhibit command only affects an automatic test scheduled to run in the next seven days. Multiple issues of the Test Inhibit command result in the deferral of the next automatic test until at least seven days after the last request. This command has no affect if an automatic test is not scheduled to take place in the next week. Starting a test manually overrides the Test Inhibit command.

The automatic test feature is on by default. To turn auto-test off, change Test Interval to 0 days in the Setup Menu. Auto-test may be enabled at any time by changing the test interval to any numerical value (excluding “0”). The default test interval is 30 days.

Test Countdown: Indicates a pending automatic test.

Test Duration: The Test Duration is adjustable to meet customer requirements. Exercise caution when increasing the parameter because long self tests compromise the standby capability during and shortly after, the test.

Standby Time and Standby Events: Counters that are not incremented during self-tests.

4.8 Providing Power via Portable Generator or Inverter

In the event of an extended utility failure, an external AC or DC power supply can provide backup power to the system. This backup power enables the power supply to continue charging the batteries ensuring interrupted service to the network. Follow the documentation and connection procedures listed below.

4.8.1 DC Powering

The AlphaGen Portable Generator provides a convenient method of providing backup DC power. Upon the loss of commercial AC power, the existing battery strings immediately supply voltage to the inverter module. After some point of battery discharge, a portable generator can be deployed to the site to supply power to the DC bus. For complete connection and operation information of the AlphaGen Portable Generator, refer its operator's manual (Alpha P/N 041-028-B0).

4.8.2 AC Powering

Should it become necessary to power the CATV system with a portable AC generator, truck-mounted AC generator or truck-mounted inverter, follow the procedures below for the protection of service personnel and powering system equipment.

Connection Procedure:

1. Read the Smart Display to determine if there is output power to the system. If there is still power to the system, check the battery voltage on the Smart Display:
   - If the battery voltage is greater than 34.5Vdc (3-battery system) or 46.0Vdc (4-battery system) then approximately one hour remains to complete the changeover to generator power before the cable system loses power to its customers.
   - If the battery voltage is less than the previous numbers, move rapidly as there is not much time until the system fails. However, exercise caution as there are dangerous voltages in the system that can shock you or damage the cable amplifiers.
2. Verify the AC Input breaker from the utility powering system is in the OFF position. This ensures that if power returns suddenly, you will not experience a surge in power. This also ensures when the generator is connected it will not put AC voltage back onto the power lines.
3. Properly ground the generator by connecting a #6 AWG wire from the grounding lug on the output panel of the generator to either a driven ground rod or the strand ground on the pole to which the power supply is mounted. If working with a ground-mounted power supply, locate the grounding point inside the enclosure and clamp on to that point.

CAUTION!

Grounding the generator is *mandatory* for safety and for proper operation of the power supply.

4.9 Providing Power via Portable Generator or Inverter, continued

4.8.2 AC Powering, continued

4. After the generator is properly grounded, unplug the power supply from the convenience outlet inside the enclosure and plug the power supply input cable into the generator output. Use an NEC or UL approved extension cord.

5. Start and operate the generator according to the generator operation manual.

6. If the generator kilowatt rating is twice the kilowatts used by the power supply indicated on the Smart Display, leave the battery breaker on and the generator will charge the batteries. If the generator fails, the power supply will continue to provide battery backup. If the generator output is not approximately twice the kilowatt rating indicated on the Smart Display, switch the battery breaker off to reduce the load on the generator if battery backup of the system is unavailable.

7. In either case, after the power from the generator is applied to the power supply, use the Smart Display to increase the Frequency Input Tolerance to ±6Hz from the normal ±3Hz, inhibiting the power supply from switching to battery backup if the generator occasionally does not operate on the proper frequency. It is not uncommon for smaller (4 kilowatt or less) sized generators to get “off frequency” due to the step loading of the power supply.

WARNING!

Ground the vehicle before operating a truck inverter or truck-mounted generator. Failure to do so places service personnel at risk for electric shock.

4.8.3 Using a Truck-mounted Inverter or Generator

To use a truck-mounted inverter or generator follow the steps listed in Section 4.8.2 with the additional step of grounding the truck. Run the ground wire from an unpainted point on the truck chassis to either a driven ground rod or strand ground to complete the grounding circuit. The rubber tires on the truck insulate it from being grounded in all but the most exceptional circumstances.

4.9 Resumption of Utility Power

WARNING!

Use caution when disconnecting and reconnecting a generator to utility power. Dangerous voltages are present.

CAUTION!

Exercise care to ensure that both powering systems are **not** connected at the same time or damage to the power supply and the generator may result.

1. Before turning on the AC voltage input breaker, use a voltmeter to verify the input voltage is within specifications.
2. When the proper voltage is present, verify the battery voltage indicated on the Smart Display is greater than 31.5Vdc or 42.0Vdc (3 or 4 battery systems respectively). Disconnect the power supply from the generator output and plug the power supply input cord into the convenience outlet within the enclosure. The power supply operates on battery backup for this short period of time, but exercise caution during this changeover as the grounding circuit to the power supply is broken.

   If the batteries are at or below the low voltage cutoff, then the power supply will NOT transfer to battery back up and there will be a momentary power outage to the cable system while you make this changeover.
3. Turn on the AC input power.
4. Shut down the generator and remove the grounding system.

5.0 Intelligent CableUPS Maintenance

A routine maintenance program, performed every three to six months, ensures the Intelligent CableUPS will provide years of trouble-free operation.

Good battery care is the first step in any power supply maintenance program. In addition to voltage checks, visually inspect the batteries for signs of cracking, leaking or swelling.

To aid in quick identification and tracking of voltages in the maintenance log, number the batteries inside the enclosure using labels or masking tape. Batteries are temperature sensitive and susceptible to overcharging and undercharging. Since batteries behave differently in the winter than in the summer, Alpha's battery chargers automatically compensate for changes in temperature by adjusting float and accept charge voltages.

CAUTION!

- The power supply must be serviced by qualified personnel.
- Use heavy gloves when handling a unit that has recently been taken out of service. The ferroresonant transformer generates heat that may cause burns if handled with bare hands.
- Alpha Technologies is not responsible for battery damage due to improper charger voltage settings. Consult the battery manufacturer for correct charger voltage requirements.
- When removing batteries, ALWAYS switch the battery breaker off before unplugging the battery connector.
- Always wear safety glasses when working with batteries.

5.1 System Information

Observe and record the following system information from the Operation Normal and Comms Status Menus in the maintenance log in Section 5.8.

Operation Normal:	Input Voltage	Output Voltage (if PIM installed)
	Output 1 Voltage	Output 2 Current (if PIM installed)
	Output 1 Current	Standby Events
	Battery Voltage	Charger Mode
	Total Standby Time	Operation Mode
	Battery Temperature	Charger Current
	Input Frequency	Output Watts
	Output VA	Percent Load

Comms Status/Menu:	CM (Address)				
	CM MAC				
	CM Version				
	CMRX				
	CMTX				
	DN FREQ				
	UP FREQ				
	MODEL				
	SW				
The DSM3x can monitor up to 4 x 48V battery strings.	BATT (Str A)	A1	A2	A3	A4
	BATT (Str B)	B1	B2	B3	B4
	BATT (Str C)	C1	C2	C3	C4
	BATT (Str D)	D1	D2	D3	D4

5.2 Battery Charger Voltage

The advanced three-stage charging features of the Intelligent CableUPS are completely self-monitoring. During normal power supply operations, the power supply continuously verifies the operating condition of the battery charger. If, for any reason, the battery charger fails, a Charger Fail alarm displays on the Smart Display. No operator voltage checks are required.

5.3 Battery Terminals and Connecting Wires

- Check each battery terminal and connection.
- Verify the hardware is clean and the crimped connectors are tight. Terminal connectors should be torqued and re-torqued to the battery manufacturer's recommended specifications.
- If there is an "in-line" fuse in the battery cable, check the fuse holder and fuse.
- Verify the terminals are properly protected with an approved battery terminal corrosion inhibitor such as NCP-2.
- Record date of maintenance in the maintenance log.

NOTE:

Whenever the battery breaker is turned off or the batteries are not connected, the CableUPS automatically reports a No Batteries alarm. This is a built in safety feature. The unit does not attempt inverter operations, either standby or test, during a No Battery alarm.

5.4 Output Voltage

Observe Output voltages using the Smart Display. Record the voltages in the maintenance log.

5.5 Output Current

With the power supply in normal operating mode observe the Smart Display Output Current. The value of output current is dependent on the total amount of load connected to the power supply. Record the current in the maintenance log.

5.6 Check Output Connections

Inspect the output connectors to prevent problems that may be caused by improper connector engagements.

5.6.1 Visual Inspection

1. Unplug and inspect the output connections, using the Service Power Supply to safely bypass the power supply.
2. Remove the AC and DC power sources from the power supply.
3. Carefully inspect the separated halves of each connector for signs of abnormal heating, such as a deformed housing or other damage.
4. If necessary, replace the PDB and SPI harness connector.

5.7 Inverter Module Maintenance

1. Carefully remove the inverter module assembly (see Section 2.3, Inverter Module Removal and Installation).
2. Inspect the inverter module for signs of dust or corrosion.

CAUTION!

Circuit boards are static-sensitive and must be handled with care.

3. ***On legacy models:*** Remove the inverter module's cooling fan shroud and clean the fan's foam filter. Verify the fan rotates easily and is free of obstructions. Replace the filter and fan shroud (filter and fan shroud depend on unit model and version).

WARNING!

Do not remove the fan shroud (Legacy models only) if the inverter module is installed into the transformer module. The fan can start without warning, possibly placing the service technician in danger from moving parts.

4. Reinstall the inverter module (see Section 2.3 Inverter Module Removal and Installation) and test the power supply for proper operation (see Section 4.1, Start-up and Test).

NOTE:

When DIP switches SW1 and SW2 on PDB are reconfigured, all items in the setup menu are reset to the original factory defaults.

CAUTION!

If the CableUPS fails the following test, there will be a loss of power to the load. Do not perform the next test step if the power supply or batteries are suspect or the load is at a critical stage.

5. If the power supply passes all previous tests (e.g. Battery Load Test, Self Test):
   a. Turn off the utility input breaker to remove input power. The power supply goes into standby operation.

ATTENTION:

In the event of a low battery warning alarm, immediately reapply utility power and resolve alarm condition. Once the cause of the alarm has been resolved, perform Step 5.

   b. Verify there is no interruption to the output.
   c. After five minutes reapply utility power. The power supply then transfers back to Operation Normal, clears any alarms and starts the battery charger (BULK mode, if needed). This test adds standby events and time to the event counter.

5.8 Maintenance Log

Battery Maintenance																
Battery Number	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	D1	D2	D3	D4
Battery Manufacturer																
Date Code/Lot Number																
Terminal Check																
Voltage (Unloaded)																
Voltage (Loaded)																

Power Supply Maintenance	
Model Number	
Serial Number	

Operation Normal	
Operation Mode	
Input Voltage	
Input Frequency *	
Output Voltage	
Output 1 Current	
Output 2 Current	
Output Watts *	
Output VA *	
Percent Load *	
Charger Mode	
Battery Voltage	
Battery Temperature	
Charger Current	
Standby Events	
Standby Time	

**** Viewed in single-step mode***

Communications Status				
CM				
CM Mac Address				
CM Rx PWR				
CM Tx PWR				
DN Freq (MHz)				
UP Freq (MHz)				
Model				
SW				
Battery Voltage	A1	A2	A3	A4
The DSM3x can monitor up to 4 x 48V battery strings.	B1	B2	B3	B4
	C1	C2	C3	C4
	D1	D2	D3	D4

Commissioning		
Service Technician		
Date Serviced		

5.9 Repair Record

Use this form to note the specifics of required service for the power supply and as a reference for use in the event the power supply requires service at an Alpha repair facility.

RMA Number	
Date/Time (local)	
Site No. / Address / Location	
Power Supply Serial Number	
Inverter Module Serial Number	
Alarm	
Corrective Action Taken	

6.0 Specifications

6.1 Intelligent CableUPS North American Models

The following table shows the electrical, mechanical and physical specifications for the North American models of the Intelligent CableUPS.

Models:	XM2-906HP	XM2-910	XM2-1350-48	XM2-915	XM2-915HV	XM2-922	XM2-922HV	XM2-918HP	XM2-924HP
Electrical									
Input Voltage (Vac):	120/240	120/240	120/240	120/240	120/240	208/240	240	120/240	208/240
Input Voltage Window:	-30 to +20%	-20 to +15%	-20 to +15%	-20 to +15%	-30 to +15%	-20 to +15%	-30 to +15%	-20 to +15%	-20 to +15%
Input Frequency:	60Hz	60Hz	60Hz	60Hz	60Hz	60Hz	60Hz	60Hz	60Hz
Input Frequency Window:	±3Hz	±3Hz	±3Hz	±3Hz	±3Hz	±3Hz	±3Hz	±3Hz	±3Hz
Output Voltage (Vac):	63/87	63/75/87	63/75/87	63/75/87	63/75/89	63/75/87	63/75/89	63/75/87	63/75/87
Output Current (A):	8/6	10/10/10	22/15/15	15/15/15	20/17.5/15	22/22/22	22/22/22	22/18/18	22/22/24
Max Output Power (VA):	540	900	1350	1350	1350	2025	2025	1620	2160
Output Waveform:	Quasi-square wave								
Voltage Regulation[1]:	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%
Output Frequency Stability: Line Mode	60Hz Nominal								
Output Frequency Stability: Inverter Mode	60Hz, ±0.05%								
Short Circuit Protection:	<150% of maximum current rating								
Transfer Characteristics:	Uninterrupted output								
Battery Voltage (Vdc):	36	36	48	36	36	48	48	36	48
Efficiency (Typical Load Range)									
Line Mode:	80-87%	86-90%						90-92%	
Standby Mode:	79-84%	82-85%						84-86%	
Battery Charger									
Temperature Compensation:	Programmable (0 to 5mV/Cell/°C)								
Charger Current:	10A at 80% load and nominal input (bulk charge mode)								
Three Stage:	Bulk, Accept, Float								
Mechanical									
Status Display:	2 x 20 Blue LCD with backlight								
Dimensions H x W x D (in/mm):	8.8 x 15 x 13 / 222 x 381 x 330								
Approx. Weight (lb/kg):	53/24	62/28.1	70/31.8	70/31.8	72/32.7	92/41.7	96/43.5	72/32.7	95/42.9
Finish:	Black, epoxy powdercoat								
Environment									
Operating Temperature:	-40 to 55°C / -40 to 131°F								
Relative Humidity:	0 to 95% non-condensing								
Agency Compliance:	FCC Part 15 Class A, UL1778, UL1012, CSA 22.2 No. 107.1								
Optional Features									
Standard Protective Interface Module (PIM/N+1): Provides two programmable outputs from a single XM2 CableUPS power supply for redundancy in critical applications. The PIM protects system components and provides isolation between distribution legs by shutting down the individual load during over-current conditions.									
[1] Note: Voltage regulation is maintained over both line and load ranges.									

Table 6-1 Specifications for North American Models

6.2 Intelligent CableUPS International Models

The following table shows the electrical, mechanical and physical specifications for the International models of the Intelligent CableUPS.

XM2 Models:	906HP	906G5	608G5	910	915E	915M	915P	622CE	615CE HP	918HP
Electrical										
Input Voltage (Vac):	120/240	115/230	115/230	120/240	190/220/247	100/112/127	190/220/253	230	230	120/240
Input Voltage Window:	-30 to +20%	-30 to +20%	-30 to +20%	-20 to +15%	-20 to +15%	-20 to +15%	-20 to +15%	-20 to +15%	-20 to +15%	-20 to +15%
Input Voltage Window w/ATS:	n/a	n/a	n/a	n/a	-30 to +25%	-30 to +25%	-30 to +25%	n/a	n/a	n/a
Input Frequency:	60Hz	50Hz	50Hz	60Hz	50Hz	60Hz	60Hz	50Hz	50Hz	60Hz
Input Frequency Window:	±3Hz	±3Hz	±3Hz	±3Hz	±3Hz	±3Hz	±3Hz	±3Hz	±3Hz	±3Hz
Output Voltage (Vac):	63/87	63/87	63	63/75/87	63/75/87	63/75/87	63/75/87	63/48	63/48	63/75/87
Output Current (A):	8/6	8/6	8	10/10/10	15/15/15	15/15/15	15/15/15	22/22	15/15	22/18/18
Max Output Power (VA):	540	540	540	900	1350	1350	1350	1350	900	1620
Output Waveform:	Quasi-square wave									
Voltage Regulation[1]:	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%
Output Frequency Stability: Line Mode	60Hz Nominal	50Hz Nominal		60Hz Nominal	50Hz Nominal	60Hz Nominal		50Hz Nominal		60Hz Nominal
Output Frequency Stability: Inverter Mode	60Hz, ±0.05%	50Hz, ±0.05%		60Hz, ±0.05%	50Hz, ±0.05%	60Hz, ±0.05%		50Hz, ±0.05%		60Hz, ±0.05%
Short Circuit Protection:	<150% of maximum current rating									
Transfer Characteristics:	Uninterrupted output									
Battery Voltage (Vdc):	36	36	36	36	36	36	36	48	36	36
Efficiency (Typical Load Range)										
Line Mode:	80-87%			86-90%					88-92%	
Standby Mode:	79-84%			82-85%					84-86%	
Battery Charger										
Temperature Compensation:	Programmable (0 to 5mV/Cell/°C)									
Charger Current:	10A at 80% load and nominal input (bulk charge mode)									
Three Stage:	Bulk, Accept, Float									
Mechanical										
Status Display:	2 x 20 Blue LCD with backlight									
Dimensions H x W x D (in/mm):	8.8 x 15 x 13 / 222 x 381 x 330									
Approx. Weight (lb/kg):	53/24	62/28.1	62/28.1	62/28.1	82/37.2	70/31.8	70/31.8	82/37.2	70/31.8	72/32.7
Finish:	Black, epoxy powdercoat									
Environment										
Operating Temperature:	-40 to 55°C / -40 to 131°F									
Relative Humidity:	0 to 95% non-condensing									
Agency Compliance										
FCC Part 15 Class A, UL1778, UL1012, CSA 22.2 No. 107.1:	Yes	-	-	Yes	-	-	-	-	-	Yes
CE, EN50083-2, EN62040-2, EN60950-1, EN62040-1:	-	-	Yes	-	-	-	-	Yes	Yes	-
CB Scheme, IEC 60950-1, EMC to CISPR22 Class A:	-	Yes	Yes	-	Yes[2]	Yes	Yes[3]	-	-	-
Optional Features										
Standard Protective Interface Module (PIM/N+1): Provides two programmable outputs from a single XM2 CableUPS power supply for redundancy in critical applications. The PIM protects system components and provides isolation between distribution legs by shutting down the individual load during over-current conditions. Five Output Protective Interface Module (PIM): Provides four programmable outputs from a single XM2 CableUPS power supply for protection in centralized powering applications. The PIM protects system components and provides isolation between distribution legs by shutting down the individual load during over-current conditions. An Optical Network Unit (ONU) output is tied to Output 2. Automatic Tap Switch (ATS): The ATS extends the input AC operating voltage range as indicated above. The ATS is used when a broader input operating range is needed due to utility voltage fluctuations and is currently available in XM2-915 E/P/M models. Not used in the United States or Canada.									

Note: Voltage regulation is maintained over both line and load ranges.
Note: Certified to CB Scheme and IEC 60950-1.
Note: Available only for XM2-915P-CB models.

Table 6-2 Specifications for International Models

6.3 Safety and EMC Compliance

North American Product Compliance (60Hz Models)	
Safety (NRTL/C)	
	UL1778 and CSA C22.2 No.107.1, CSA C22.2 No. 107.3 UL/CSA 60950-1
Electromagnetic Compatibility (EMC):	
	FCC Part 15, sub-part B, Class A

European Union Product Compliance (50Hz Models)	
Safety (CE)	
Low Voltage Directive	2006/95/EC
Technical Standards	EN 62040-1-2
	EN 60950-1
	EN 50083-1
Electromagnetic Compatibility (EMC)	
EMC Directive	2004/108/EC
Technical Standards	EN 62040-2 Category 2

Table 6-3, Product Certifications

7.0 Return and Repair Information

In the event you need to return the Intelligent CableUPS.to Alpha Technologies for service, a Return Material Authorization (RMA) form must accompany the unit. The form can be found at Alpha's Web site (www.alpha.com/rma). Follow the instructions contained in the form to obtain an RMA. Once an RMA number has been issued, pack the unit per instructions and return to the service center assigned by Alpha Technologies. Or, if preferred, contact Alpha Technologies at (800) 322-5742 for assistance.

NOTE:

Any information pertaining to the nature of the power supply failure or problem, along with a copy of the power supply's maintenance log, should be included with the returned power supply.

7.1 Emergency Shutdown

The Intelligent CableUPS contains more than one live circuit. During an emergency, utility power can be disconnected at the service entrance or main electrical panel to protect emergency personnel. However, power is still present at the output. To prevent the possibility of injury to service or emergency personnel, always follow this procedure to safely shutdown the power supply.

Emergency Shutdown Procedure:

- **STEP 1**: Turn the battery breaker to OFF.
- **STEP 2**: Unplug the AC Input Line Cord from the service entrance.
- **STEP 3**: Unplug both the Output 1 and Output 2 connections.
- **STEP 4**: If applicable, unplug the N+1 connections.

Fig. 7-1 Emergency Shutdown

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Alpha Technologies Inc.
3767 Alpha Way
Bellingham, WA 98226
United States
Tel: +1 360 647 2360
Fax: +1 360 671 4936

Alpha Energy
1628 W Williams Drive
Phoenix, AZ 85027
United States
Tel: +1 602 997 1007
Fax: +1 623 249 7833

Alpha Technologies Europe Ltd.
Twyford House Thorley
Bishop's Stortford
Hertfordshire, CM22 7PA
United Kingdom
Tel: +44 1279 501110
Fax: +44 1279 659870

Alpha Technologies
Suite 1903, 19/F., Tower 1
33 Canton Road, Tsim Sha Tsui
China Hong Kong City, Kowloon
Hong Kong
Phone: +852 2736 8663
Fax: +852 2199 7988

Alpha Technologies Ltd.
7700 Riverfront Gate
Burnaby, BC V5J 5M4
Canada
Tel: +1 604 436 5900
Fax: +1 604 436 1233
Toll Free: +1 800 667 8743

Alpha Technologies GmbH
Hansastrasse 8
D-91126
Schwabach, Germany
Tel: +49 9122 79889 0
Fax: +49 9122 79889 21

Alphatec Ltd.
339 St. Andrews St.
Suite 101 Andrea Chambers
P.O. Box 56468
3307 Limassol, Cyprus
Tel: +357 25 375 675
Fax: +357 25 359 595

Alpha Innovations Brasil
Avenida Ibirapuera,
2120 – Cj 76
Moema - 04028-001
Santos SP, Brazil
Tel: +55 11 2476 0150
Fax: +55 11 2476 0150

Alpha Industrial Power Inc.
1075 Satellite Blvd NW,
Suite 400
Suwanee, GA 30024
United States
Tel: +1 678 475 3995
Fax: +1 678 584 9259

Technologies Argus First de Mexico
Anatole France Num. 17
Colonia Polanco
11560, México D.F.
Tel: +52 55 5280 6990

Alpha TEK ooo
Khokhlovskiy Pereulok 16
Stroenie 1, Office 403
Moscow, 109028
Russia
Tel: +7 495 916 1854
Fax: +7 495 916 1349

Alphatec Baltic
S. Konarskio Street 49-201
Vilnius, LT-03123
Lithuania
Tel: +370 5 210 5291
Fax: +370 5 210 5292

Visit us at www.alpha.com

Power

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